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GROWING ELECTRICAL EXPORTS.

In commenting upon the returns of the Department of Commerce and Labor for electrical exports during July, we called attention to the fact that the data had been thrown into new form. The old divisions of electrical instruments and electrical machinery—a fairly sensible and natural differentiation between things one can handle and things he cannot lift—were merged into a new classification of "electrical machinery, appliances and instruments." Here is covered the entire range between a delicate wireless set and an electric motor or locomotive—but if one cannot get rather fine details, the whole lot of stuff might just as well be lumped this way. And yet there are subdivisions of various kinds, such as electrical machinery as one class and motors or generators as another class, with fans thrown in as a kind of intermediary makeweight. Then there are arc and incandescent lamps, motors, telegraph instruments and telephones, and then that embracing class, like Christian charity, covering a multitude of exporters, "all others." The joke is that in August "all others" came to $1,398,159 out of $2,100,761, which hardly seems fair. We feel that an "all others" class is subject to suspicion and explanation and ought to show just who the contributors were.

Overlooking these essential details, it is interesting and encouraging to note that, as in July, the figures of electrical export for both August and September show considerable increase. The total for July was $1,932,619, as compared with the same month in 1911 of $1,291,929. In August the figures were $2,100,761, as compared with $1,391,689, while in September the returns were $1,852,400 against $1,500,600. If we knew a little more about our "all others" emigrant electrical apparatus, it would be possible to offer some modest comments on the course of trade, but the overwhelming obscurity of two-thirds of the values given reduces a critic to the position of one trying to explain under just which thimble the Republican vote could be found in the last political campaign.

THE BERGEN HYDROELECTRIC PLANT.

In this issue there is described an important project for energy transmission which has just been carried out by the city of Bergen, Norway. Situated as Bergen is, at about 60 deg. north latitude, lighting is a more than usually important consideration throughout certain months. Moreover, the city is active as a commercial and manufacturing center and an important port with a considerable amount of shipbuilding. The mountains of Norway lie near the coast and the water-powers therefore are not remote and are advantageous to develop on account of generally high heads. From a hydraulic standpoint the situation is interesting. The west coast of Norway is notable for very

high precipitation, subject, as is frequently the case in similar situations, to large variations from place to place. In this case the hydraulic resources consist of an upper lake, which receives the water from four small rivers, and a lower lake, 600 ft. below and somewhat nearer the coast, which unite in sending their discharge into a third lake 22 miles from Bergen. Here the present plant is located. At the lower level the precipitation averages 100 in. per year, while on the upper drainage area the average rises to 150 in. This large difference between drainage areas only a few miles apart is both instructive and characteristic. The project now carried out involves the utilization of the lower fall of a little over 500 ft. and the regulation of the flow at the upper reservoir, which will be utilized later.

In the development of the lower fall it was necessary to carry a tunnel 2.5 miles to the forebay from which the penstocks pass. The present generating equipment, which utilizes only a small part of the full power available, consists of three 3000-kw, 50-cycle, three-phase generators, wound for 7250 volts. These are directly coupled to turbines of the Francis type, yielding 3500 hp at 500 r.p.m. The exciters running at the same speed are driven by wheels of the Pelton type. It is somewhat interesting to see these two American hydraulic improvements coming into their own in foreign practice. Each generator is connected to its own 3000-kw water-cooled transformer, with which ordinarily it is operated as a unit. In case of a breakdown provision is made for connecting to auxiliary busbars so that the system can be worked with any one of its units out of service. This treatment of generator and transformer as a working unit tends greatly to the simplification of the system and is a scheme decidedly to be commended. A great deal is sometimes sacrificed in stations to secure an altogether needless degree of flexibility. One does not require in a steam-driven station that each steam turbine should be arranged so as to operate any one of the electrical generators, and there is no particular reason why water-driven generator and transformer together should not be regarded as the fundamental operating unit.

The transmission line, about 22 miles in length, is worked at approximately 50,000 volts with solid hard-drawn copper conductors carried on three-disk suspension insulators. The supporting structure carrying the double circuits with a spacing between wires of about 6 ft. we commend to our readers as representing an important development in line construction well known abroad but little honored here. The standard support, as shown in our illustration, is not a tower in the sense in which the word is used here, but a carefully designed, although slender-looking, "A-frame." This somewhat flexible structure is replaced at angles and similar points of special stress by a four-legged anchor tower. The average span is 560 ft. This structure of skilfully anchored A-frames is both economical and effective, and the fact that it has been adopted for the somewhat formidable winter climate of Norway ought to encourage its more frequent trial in American practice. Work in the further development of the great power available for Bergen is soon to be undertaken, and within a short time that city should be as well provided with hydroelectric power as is any place of its size in the world.

THE PRACTICAL LIGHTING ECONOMICS OF HIGH-PRESSURE GAS.

The article by Mr. T. Osborne on the competitive tests of electric flame-arc lamps and high-pressure gas lamps in the municipal lighting of Manchester, England, contains much that is worth consideration. The municipal authorities decided to make a thorough examination of the two systems, two well-known experts being retained to investigate the whole matter. Two important streets, one lighted by magazine flame-arc lamps and the other by "press-gas" lamps, were taken for comparison. The former lamps were equipped with clear inner globes and opalescent outer globes and were hung 27.5 ft. above the center of the street, spaced roughly 120 ft. At the important angle of 20 deg. to 25 deg. below the horizontal these arc lamps give a little short of 3000 cp on the average, and each lamp contains fourteen pairs of electrodes having an average life of at least five hours per pair. The minimum illumination produced by the lamps spaced as described was fully up to 0.5 foot-candle, a figure we take pleasure in commending to the consideration of American municipal authorities. The press-gas lamps, spaced somewhat more closely, gave 1750 cp. Much of the article is directed toward the analysis of costs, which would have to be modified if one were making similar computations for American conditions. It is worth noting, however, that the electrodes cost only $18.24 per 1000 pairs, a fact of interest to tariff reformers.

As regards reliability of service, the experts found a considerable advantage in the use of the flame-arc lamps, which, moreover, showed less variation between the extremes of candle-power. Either system, however, seems to have been reasonably reliable. On the basis of light for equal cost the flame-arc lamp, as might be expected, shows to great advantage, costing less than one-third as much as the equivalent press-gas lamps. They also cost less in capital charges than do the press-gas lamps. From every point of view the flame-arc lamps are better than the press-gas lamps in the matter of economy, and indeed it was found that even if the gas lamps had been working at double the efficiency actually reached in practice they still would have been less economical than the electric-arc lamps.

The results of these tests, which will well repay much more than a cursory examination, are quite in line with the results of impartial investigation elsewhere. We do not attach great importance to figures of cost made in frankly competitive plants, but in this case the municipality was operating both systems and desired for its own information the real facts as to relative economy. Press-gas lamps furnish under favorable circumstances an admirable and fairly cheap form of illumination, much cheaper than gas lamps not used under pressure, much cheaper also than the older forms of electric-arc lamps; but when they come into competition with a first-class installation of modern flame or luminous-arc lamps the balance turns quite the other way, even at foreign prices for gas. In this country the difference is still further exaggerated, and the reason why press gas has not been introduced into American practice to any considerable extent becomes sufficiently evident. In addition, it seems to be a general rule that the high-efficiency gas equipments developed abroad do not in their original forms give as good service on American as on European

gas-lighting systems. This is not necessarily to the discredit of the former. It merely indicates that the conditions of maximum efficiency have changed and that the burners must be modified to meet these conditions, which involves not a little hard work and development expense. Certainly, on the showing of Mr. Osborne's paper there is very little encouragement for American municipalities to take up press-gas lamps when efficient flame-arc lamps can be obtained. The Manchester flame-arc lamps undoubtedly showed a low specific consumption, a little less than 0.24 watt per candle for the light at the useful angle, which is a very good performance for a lamp with an opal globe. The gas lamps apparently showed somewhat higher consumption than had been reached in other places, but the discrepancy in results was so great as completely to swamp any variations of such sort. On the showing made in Manchester, the American central station has little reason to worry about the possible introduction of press gas in this country.

THE PATENT OFFICE.

Elsewhere will be found an abstract of the report of President Taft's Commission on Economy and Efficiency, which has just completed an investigation of the Patent Office under the authorization of Congress. This, as we have pointed out before, is but one of the phases of the broader question of patent reform and represents a piecemeal method of attack not best suited to disposing of the subject. Nevertheless, the report calls attention to some of the well-known abuses and defects under the present system and merits careful study. The housing of the patent departments is seriously deficient in various respects, important among which is the large fire hazard. The examining force is deficient and underpaid, and the administrative supervision which the commissioner and his aids are now able to give is insufficient. It is proposed to abolish one appeal within the office in order to expedite procedure and also to raise the initial or filing fee from $15 to $20 to cover fully the cost of an adequate search and examination.

One of the prominent abuses under the present system is the practice of keeping applications pending in the office for years. This it is proposed to correct by dating a patent from the time of filing application, allowing perhaps two years for getting the application through the office to issue. It is recommended that the important work of digesting and reclassifying the knowledge of each art down to date be supported by a special appropriation and completed as speedily as possible. The commission exceeded the authority granted by Congress and canvassed the sentiment for a single Court of Patent Appeals, which it favors, and set forth the German and English laws in reference to compulsory license and working. The remedy for granting invalid patents, the commission concludes, lies in perfecting the examination system, which is now inadequate. No hearings were held and no testimony was taken, but opinions were solicited by circular. If the work of the commission is open to any substantial criticism, it is probably in the respect that the replies to its circulars of inquiry were unduly representative of patent attorneys, whose views of the needs of the situation cannot be accepted as altogether altruistic.

THE SILVER VOLTAMETER.

We print on another page of this number the first two of a short series of articles by Dr. Rosa and his collaborators at the Bureau of Standards on certain experimental researches with the silver voltameter. Our readers will remember that, in consequence of the action taken at the London International Conference on electromagnetic units, the whole of electrical engineering, considered as a quantitative performance, rests for its precision upon the fundamental standard international ohm and the standard international ampere. These concrete standards present themselves in our various national laboratories, respectively in the form of metallic resistors and current balances that have been calibrated by silver voltameters. At the Chicago Congress of 1893 the chamber of delegates adopted the international ohm, volt and ampere, the first defined by reference to a definite mercury-column resistor, the second in terms of the Clark-cell emf, and the third in terms of electrolytic deposit in a silver voltameter. Here were three concrete standards, from any two of which the performance of the third could be predicted by Ohm's law.

As not unfrequently happens, however, when generosity adds surfeit to necessity, the excess bred discord. Certain small but appreciable errors and discrepancies manifested themselves in voltmeters or ammeters standardized carefully in different countries. Some of these countries reduced all their standards ultimately to the international ohm and volt, others to the international ohm and ampere. It became evident that, so long as there were three fundamental legal standards and small discrepancies existed between them, no satisfactory degree of international agreement could be reached. At the London conference of 1908 it was therefore agreed that the ohm and ampere should be the two fundamental international standards, and that the volt should be determined with reference to these two. This plan eliminated the pre-existing ambiguity, but it magnified the importance of the silver voltameter and its technique.

The series of articles now commenced as the result of a large amount of experimental work done at the Bureau of Standards show that the silver voltameter is chemically contaminated if filter paper is used in its technique, even though that paper be pure, clear and carefully washed. It seems that pure cellulose in the filter paper enters into combination with silver nitrate to form oxycelluloses in such a manner that the electrolytic deposit of silver from such contaminated solutions is slightly, but very appreciably, heavier than from solutions which have not come into contact with cellulose. Moreover, the character of the metallic deposit is distinctly altered in its microscopic appearance.

The story told by the series of articles is very fascinating, from the standpoint of scientific research, and also of great importance from the standpoint of engineering. It is not that the error involved in engineering measurements is serious industrially. Few engineering measurements have sufficient precision to be effected thereby. It is that the intellectual and physical agreements between the standards kept in the different national laboratories of the civilized world are readily capable of being vitiated by an overlooked flaw in organic chemistry as applied to international engineering.

N. E. L. A. COMMITTEE MEETING IN CHICAGO.

Following the decision to hold next year's convention of the National Electric Light Association in the new Medinah Temple, Chicago, during the first week in June, several important committee meetings were held in Chicago this week. The first was that of the executive committee of the Commercial Section, which was held on Monday, Dec. 9, in the Hotel Sherman. Mr. E. W. Lloyd, of Chicago, the chairman of the committee, presided and Mr. E. L. Callahan, of the same city, performed his duties as secretary, assisted by Miss Gladys Burkhalter, assistant secretary. Other members present were Messrs. F. H. Gale, Schenectady; Douglas Burnett, Baltimore; M. C. Rypinski, New York; N. H. Boynton, Cleveland (representing J. Robert Crouse); C. A. Littlefield, New York; E. McCleary, Detroit; J. C. McQuiston, Pittsburgh; George Williams, New York; P. S. Dodd, New York, and H. J. Gille, St. Paul.

The report of the membership committee, of which Mr. J. F. Becker, of New York, is chairman, was presented and the plan of campaign for securing new members was discussed at length. It was decided to offer a prize for the person who secures the greatest number of new members for the Commercial Section before the Chicago convention.

From the publications committee Mr. Burnett reported that 130,000 copies of the publications of the Commercial Section of the N. E. L. A. have been sold or distributed. Of one small booklet, "Electric Service in the Home," 80,000 copies have been printed and 65,000 have been sold. A follow-up book on domestic uses of electricity will be ready about Feb. 1. There will also be publications relating to electricity on the farm, store lighting and the use of electricity in small motors.

Mr. Gale reported for the finance committee, of which Mr. T. I. Jones, of Brooklyn, N. Y., is chairman.

The committee on electrical salesman's handbook reported through Mr. Callahan, its chairman. Supplementing the book distributed at the Seattle convention the first quarterly supplementary issue has been mailed already to members of the Commercial Section. The second quarterly issue will be mailed about Jan. 1.

The committee on electricity on the farm has been divided into three geographical sections, Mr. Stanley V. Walton, of San Francisco, being chairman of the Western States section; Mr. C. W. Pen Dell, of Chicago, chairman of the Middle States section, and Mr. John C. Parker, of Rochester, chairman of the Eastern States section.

Mr. R. S. Hale, of Boston, chairman of the committee on wiring of existing buildings, sent a letter which indicates that the committee will have an interesting report.

For Mr. George Harvey Jones, of Chicago, chairman of the committee on ice and refrigeration, Mr. Lloyd reported that the committee was actively at work and would undoubtedly submit a valuable report.

Mr. McQuiston read a letter from Mr. M. S. Seelman, Jr., of Brooklyn, N. Y., giving a report of the recent meeting of the committee on electrical merchandising, of which Mr. T. I. Jones, of Brooklyn, is chairman and Mr. Seelman is secretary. This meeting was held on Dec. 4, and a good start was made on the work of the committee.

For Mr. J. Robert Crouse, of Cleveland, chairman of the committee on advertising, Mr. Boynton presented a report showing the methods that are being taken to interest member companies in the subject of advertising.

Much interest was shown in the report of the committee on education of salesmen, of which Mr. George Williams is chairman. The discussion related to various methods of procedure, as by company lectures, correspondence courses, etc. It is probable that before any method is adopted the subject will be presented to the full association for its final decision.

In relation to short cuts in executing customers' orders Mr. Lloyd reported that this committee, of which Mr. George C. Holberton, of San Francisco, is chairman, is at work and can report progress. The deliberations of the full committee filled a long and busy day and at its conclusion the members of the committee were entertained at dinner at the Chicago Athletic Club by Mr. Lloyd.

The next meeting of the executive committee of the Commercial Section will be held in the headquarters of the National Electric Light Association in New York on Jan. 31.

A brief meeting of Mr. Burnett's committee on publications was held on Tuesday morning at the Hotel LaSalle, and on Wednesday there was a meeting of the exhibition committee, of which Mr. J. C. McQuiston is chairman and Mr. Walter Neumuller is secretary. Following the meeting of the committee Chairman McQuiston entertained the members and guests at luncheon.

At the meeting of the exhibition committee held on Dec. 11 there were present Messrs. J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company; F. H. Gale, of the General Electric Company; S. E. Doane, of the National Quality Lamp Division of the General Electric Company; James I. Ayer, of the Simplex Electric Heating Company; George B. Foster, Chicago (representing John F. Gilchrist, of the Commonwealth Edison Company), and Frank N. Jewett, of the Wagner Electric Manufacturing Company. Mr. H. E. Niesz, manager of the Cosmopolitan Electric Company, Chicago, was elected a member of the committee, being well fitted for the work by his experience in managing previous electrical exhibitions. Mr. T. C. Martin, secretary of the National Electric Light Association, was present in his official capacity, and Mr. George W. Elliott, master of transportation, was present at the morning session. Mr. Walter Neumuller, of the New York Edison Company, who has served as secretary of the committee with a very high degree of efficiency for a number of years, was compelled to resign that position owing to pressure of other duties. Mr. H. C. McConnaughy, New York, of the Dearborn Drug & Chemical Works, a member of the committee, was elected to succeed Mr. Neumuller as secretary.

Mr. Niesz and Mr. McConnaughy were empowered to make all the arrangements for holding the exhibition in connection with the 1913 convention of the National Electric Light Association in Medinah Temple, Chicago, on June 2 to 5 inclusive. The exhibition will be opened with a reception on Monday evening and will continue until Friday evening. In the afternoon the members of the committee visited Medinah Temple and inspected the facilities which will be placed at the disposal of the convention. The visitors were much pleased with the building and the ease with which it can be adapted to the purposes of such a convention as the next annual gathering of the National Electric Light Association promises to be. Plans are now being formulated for appropriate rooms for four or five sections meeting simultaneously. The next meeting of the exhibition committee will be held in the New York headquarters of the N. E. L. A. on Jan. 30.

NOMINATIONS FOR OFFICERS OF A. I. E. E.

Modifications introduced last year in the method of making nominations for the various offices to be filled at the 1913 election of the American Institute of Electrical Engineers permit advance nominations to be made by petition so that the names thus received may be mailed to the membership on Feb. 1 on the official nomination forms. An indorsement of not less than fifty members is necessary to effect such publication, and it is necessary for the petitions or indorsements to be in the hands of the secretary not later than Jan. 25, 1913. Copies of the petition form may be obtained upon application to the Institute headquarters, but the form is not necessary, indorsements by letter being

just as valid. The officers to be elected are a president and a treasurer for a term of one year, three vice-presidents for a term of two years, and four managers for a term of three years.

THE PRESIDENT'S MESSAGE TO CONGRESS.

President Taft sent to Congress on Dec. 3 a message dealing with all departments of the government except the State Department, which was covered in a separate message taking up also our foreign trade relations, as mentioned elsewhere in this issue.

In dealing with the subject of the tariff Mr. Taft practically turned it over to the next administration, which will take office on March 4. This statement was significant:

"Now that a new Congress has been elected on a platform of a tariff for revenue only, rather than a protective tariff, and is to revise the tariff on that basis, it is needless for me to occupy the time of this Congress with arguments or recommendations in favor of a protective tariff."

That portion of the message which dealt with the regulation and control of water-power is especially interesting. It follows in full.

"There are pending before Congress a large number of bills proposing to grant privileges of erecting dams for the purpose of creating water-power in our navigable rivers. The pendency of these bills has brought out an important defect in the existing general dam act. That act does not, in my opinion, grant sufficient power to the federal government in dealing with the construction of such dams to exact protective conditions in the interest of navigation. It does not permit the federal government, as a condition of its permit, to require that a part of the value thus created shall be applied to the further general improvement and protection of the stream. I believe this to be one of the most important matters of internal improvement now confronting the government. Most of the navigable rivers of this country are comparatively long and shallow. In order that they may be made fully useful for navigation there has come into vogue a method of improvement known as canalization, or the slack-water method, which consists in building a series of dams and locks, each of which will create a long pool of deep navigable water. At each of these dams there is usually created also water-power of commercial value. If the water-power thus created can be made useful in the further improvement of navigation in the stream, it is manifest that the improvement will be much more quickly effected on the one hand, and, on the other, that the burden on the general taxpayers of the country will be very much reduced. Private interests seeking permits to build water-power dams in navigable streams usually urge that they thus improve navigation, and that if they do not impair navigation they should be allowed to take for themselves the entire profits of the water-power development.

"Whatever they may do by way of relieving the government of the expense of improving navigation should be given due consideration, but it must be apparent that there may be a profit beyond a reasonably liberal return upon the private investment which is a potential asset of the government in carrying out a comprehensive policy of waterway development.

"It is no objection to the retention and use of such an asset by the government that a comprehensive waterway policy will include the protection and development of the other public use of water, which cannot and should not be ignored in making and executing plans for the protection and development of navigation. It is also equally clear that, inasmuch as the water-power thus created is or may be an incident of a general scheme of waterway improvement within the constitutional jurisdiction of the federal government, the regulation of such water-power lies also within that jurisdiction.

"In my opinion constructive statesmanship requires that legislation should be enacted which will permit the development of navigation in these great rivers to go hand in hand with the utilization of this by-product of water-power, created in the course of the same improvement, and that the general dam act should be so amended as to make this possible. I deem it highly important that the nation should adopt a consistent and harmonious treatment of these water-power projects which will preserve for this purpose their value to the government, whose right it is to grant the permit. Any other policy is equivalent to throwing away a most valuable national asset."

The President also referred to the new rules of practice in the equity side of the federal courts, recently promulgated by the Supreme Court, and urged the necessity of similar reforms in the common-law side. In closing he called attention to the workman's compensation act which has passed the Senate and is now pending in the House, again recommending its passage.

RATHENAU MEDAL FOUNDED IN AMERICAN MUSEUM OF SAFETY.

A gold medal has been placed at the disposal of the American Museum of Safety, New York, by Dr. Emil Rathenau, to be awarded annually for the best device or process for safeguarding life in the electrical industry.

Rathenau Medal.

The medal will be awarded for the first time at the annual meeting of the Museum to be held on Jan. 21, 1913. It is elliptical in shape, 1.5 in. wide by 2 in. long and ⅛ in. thick, and weighs 3 oz. The medal was founded in commemoration of the seventieth birthday of Dr. Emil Rathenau, organizer and head of the Allgemeine Elektricitäts Gesellschaft (General Electric Company of Germany). It shows a picture of the donor in relief and around it the legend "Emil Rathenau, 70 years old, Dec. 11, 1908." On the obverse side there is an imperial eagle with a bee hovering near, and above the eagle a classic representation of forged lightning. Around the edge are the letters and words "A. E. G. B. E. W. für Verdienst und Treue," the four German words meaning "for merit and fidelity." There are no restrictions as to nationality in making the award, the medal being international in scope.

I. E. S. ANNUAL MEETING.

The Illuminating Engineering Society's committee on constitutional revision, which has considered proposed amendments to the constitution of the society, has issued a statement in which the principal amendments, three in number, are mentioned. The first provides for the establishment of the grade of sustaining member; the second changes the date of the fiscal year to begin Oct. 1, and the third relates to the appointment of local representatives in cities where there are no sections. The present revenue of the society is inadequate for its support on the present scale, and desirable extensions of the society's activities cannot be realized unless larger funds are available. An increase in the annual dues of members being opposed, it is planned to extend the membership of the society by the inclusion of a grade of sustaining members, consisting of individuals or organizations who shall be elected by the council and who shall pay certain annual dues. The amendment fixes the

maximum amount receivable from any one sustaining member at $250 a year. The council will decide whether the sustaining members shall pay a uniform amount or whether the dues shall be graded. The advantage of the change in the fiscal year to correspond with the period of the society's activities is believed to be one realized by all members.

The nominees selected by the board of nominations to hold office for the coming year are: President, Mr. Preston S. Millar; vice-president from Philadelphia Section, Mr. William J. Serrill; vice-president from New England Section, Mr. J. W. Cowles; vice-president from Chicago Section, Mr. J. R. Cravath; vice-president from Pittsburgh Section, Mr. H. S. Evans; general secretary, Mr. J. D. Israel; treasurer, Mr. L. B. Marks; directors, Messrs. C. O. Bond, P. W. Cobb and W. Cullen Morris.

RECOMMENDATIONS TO CONGRESS BY THE SECRETARY OF THE NAVY.

Secretary of the Navy George von L. Meyer sent to Congress on Dec. 6 an extended report containing numerous recommendations for the enlargement and improvement of the service, among which are important references to the increasing use of electricity in the navy. Aside from engineering interest in these matters, the plans of the Navy Department are of great interest to electrical manufacturers and contractors who bid for navy contracts, and on this account we have quoted somewhat extensively from the report in what follows. The department finds it advisable, in respect to organization for handling electrical work, to place all such work under the jurisdiction of the bureau of steam engineering. On this point the report says specifically:

"Electricity is becoming a great motive power. The General Electric Company is working out new designs for the use of electricity in connection with turbines, and it is important that in the machinery departments, both ashore and afloat, our officers should be experts in this line of work.

"The Vickers Company, England's largest shipbuilding concern, successful not only in the ships it builds but in its returns to stockholders, indicating great efficiency and economy, has found it advantageous to group electricity and steam engineering together.

"The practice coincides with what the department adopted here. Everything points to the increased use of electricity as a motive power for the engine room of the future; therefore it would be illogical to place the design, installation, care and maintenance of electrical machinery elsewhere than in the hands of officers who are charged with its operation and upkeep under actual service conditions at sea. This is particularly evident after three years' successful experience since the transfer of electrical work from equipment to steam engineering."

It is proposed to abolish the Bureau of Equipment and distribute its duties, assigning electric generators and accessories, electrical signal apparatus and wireless-telegraph equipment to the bureau of steam engineering.

"There is no evidence that another bureau for electrical work will be required, as the electrical duties of the old Bureau of Equipment have been satisfactorily handled for three years by the Bureau of Steam Engineering. Further, the tendency is to consolidate wherever possible so as to increase economy and efficiency."

In reference to the progress made in planning new work as recently authorized the report says:

"Specifications covering the electrical work on the battleships *Nevada* and *Oklahoma* and other craft authorized by recent legislation have been formulated. Plans for light, motor service and interior communication for the new battleships *Texas*, *New York*, *Oklahoma* and *Nevada*, for gunboats and for destroyers 43 to 50 inclusive have been prepared. Fixtures have been simplified and made cheaper and more durable.

"The electrical control of searchlights has been redesigned and a new mechanical control has been developed. It is hoped that the improvements made will result in a perfectly satisfactory light for naval purposes."

Since 1900 the General Board has furnished annually a consistent and continuing program of ship construction. This year the new construction asked for includes four battleships, two battle cruisers, sixteen destroyers, one destroyer tender, two transports, one ammunition ship, six submarines, one submarine tender, one supply ship, two gunboats, two seagoing tugs, one dry dock and one submarine testing dock. Furthermore:

"The board recommends the conversion of the *Prometheus* into a repair ship, and if this is approved one fuel ship should be provided for the building program to replace the *Prometheus*. It recommends also the conversion of the cruiser *Baltimore* into a mine transport, the *San Francisco*, a sister vessel, converted to this purpose, having proved sufficiently useful to warrant the expenditure necessary to convert the *Baltimore*. . . .

"The paramount need of the navy is, however, for battleships, and the board does not recommend any modification of the building program by which preference in building is given to battle cruisers or other fleet units and auxiliaries, which will interfere with the ultimate battleship strength. . . . .

"Since 1907 the board has consistently advocated the policy of four destroyers for each battleship, which is considered essential to a proper balance of the fleet. Tenders in the proportions of one to sixteen destroyers have become indispensable fleet auxiliaries.

"The loss by collision at sea of the steamships *Republic*, *Merida*, *Marcellus* and *Titanic* has emphasized the urgent necessity for two properly designed and equipped naval transports for use one on the Atlantic and one on the Pacific coast. The only vessels at present available for such duty are the *Prairie* and the *Buffalo*. The former is now twenty-two years old and the latter twenty. Both are single-bottom ships and entirely lacking in water-tight subdivision, having been originally designed as freighters. They further lack many things absolutely necessary for the health and comfort of officers and men on large expeditions."

The recommendations for other types of vessel were considered in detail, and then the subject of wireless communication was taken up at some length, as next quoted:

"Improvements in the radio equipment of the fleet and shore stations as regards increased range and prevention of interference during the past fiscal year have been made as rapidly as the appropriations permitted. The purchase of new radio apparatus conforming to the latest requirements is expensive, but the marked gain in efficiency makes such changes imperative.

"The high-power station at Arlington, Va., is now in operation, and messages have been exchanged with Key West and Colon. It is the first of the proposed chain of high-powered radio stations, the others to be erected on the Isthmus of Panama, on the coast of California, in Hawaii, Guam, the Philippines and Samoa. Valuable results as regards the control of the fleet at sea and widespread dissemination of time signals and storm warnings can be obtained when these stations are erected.

"The Navy Department is maintaining forty-one shore stations and six stations on light vessels. An expedition is now in Alaska modernizing and improving the older stations there and erecting a new station on the island of Unalga. The chain of Alaskan coast stations is, in conjunction with the inland army stations, of great importance commercially as an alternative means of communication in case of break-down of the cable or land telegraph lines.

"As Congress has enacted legislation regulating radio-telegraphy and making obligatory the opening of certain designated naval radio stations to paid commercial business, the radio work and expenses of the department will be largely increased. It will be necessary to modernize and improve the apparatus of coast stations so that the commercial work may be successfully handled. It is expected, at the outset at least, that much of the burden of inspection for adjustment of commercial stations will fall upon this department. But the added work will undoubtedly prove an incentive to increased efficiency and will bring the naval stations into closer touch with commercial companies and their methods of operation, which, it is hoped, will mean a better appreciation of each other's work and cordial co-operation in regulation and the minimization of interference.

"The high-powered radio station at Arlington, Va., consists of two 450-ft. and one 600-ft. self-supporting steel tower, a building containing radio apparatus, laboratories, storerooms, offices, living quarters for operating force, etc., and the necessary ground-wire system, water supply, roads, walks, etc.

"Since the introduction of high-frequency quenched-gap radio apparatus the most urgent work of the department has been the modernizing of old installations. This work has been advanced during the past year as rapidly as limited funds and the slow deliveries of contractors have permitted. Much in this line remains to be accomplished, especially in the case of coastal stations, which, as a result of pending legislation, will be thrown open to commercial work. All new ships commissioned within the year have been provided with modern apparatus, but it has not been possible properly to equip the entire fleet because sufficient funds were not available.

"With the assignment of two officers for the administration of this rapidly expanding branch it becomes possible for the first time to foresee a time when other and intrinsically more important features of this activity will be upon a satisfactory basis. These features relate to the development of radio for tactical purposes, experimentation in connection with purely naval needs, proper supervision and training of operators, and the standardization of material and operating methods."

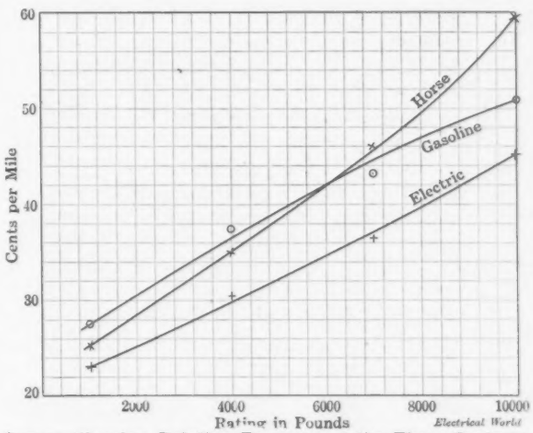
THE ELECTRIC VEHICLE AT BOSTON.

The Electric Motor Car Club of Boston held an enthusiastic meeting at the Boston City Club on Dec. 5. An extended discussion took place regarding recent progress in the electric vehicle field, and it was announced that after much effort about 1.5 miles of additional parking space had been secured for automobilists in and near the downtown district of Boston. Mr. Alfred Weatherbee, of the Anderson Electric Car Company, emphasized the need of better garaging facilities in the theater district, and it was decided to interview the city authorities in the endeavor to obtain further parking privileges in the downtown streets near the theaters after business hours.

ELECTRIC TRUCKS FOR FIRE DEPARTMENTS.

A large part of the meeting was devoted to a discussion of the growing adaptability of the electric truck to fire department service. Mr. M. B. Church, of the Couple-Gear Freight Wheel Company, Grand Rapids, Mich., referred briefly to the successful use of electrical equipment at Springfield, Mass., notably a 10-ton ladder truck capable of running 27 miles per hour. He pointed out that the high speeds attained by apparatus of this kind as compared with heavy trucks for industrial service are realized by the use of a large battery working for a short time through a highly efficient motor drive. It is unusual for a run to exceed ten or fifteen minutes. All four wheels are driven by individual motors through a 25 to 1 gear reduction with a loss of not over 3 per cent in mechanical transmission. It would not be feasible to maintain such high speeds over a protracted period. At a recent alarm in Springfield not a horse-hauled unit responded, every machine being of the motor type, and the greater part of these were electrics. At Brooklyn, N. Y., a 15,000-lb. steamer has been equipped with two Couple-Gear wheels and runs at a maximum speed of 20 miles per hour. At a recent alarm, this machine ran 0.75 mile and turned seven corners in two minutes, while a two-horse hose wagon from the same house consumed four minutes in the same run.

Mr. Ira Miller, of the Couple-Gear company, stated that complete propositions covering the electrification of fire departments entire were now being presented covering eighty-seven pieces at Buffalo, N. Y.; thirty-two pieces at Worcester, Mass.; eighteen pieces at Bridgeport, Conn., and twenty-eight pieces at Hartford, Conn. In this work the underwriters are showing much interest, as it means a great reduction in fire losses as well as decreased operating costs within the department. In each of the above cases it is estimated that the cost of the change will be paid for by the savings resulting within five years. A study of the cost of motorizing the Boston fire department along electrical lines shows that this can be done for $830,000, and that the saving will be at the rate of $150,000 a year. Reduced rates



Curves Showing Relative Economy of the Three Systems.

are offered by the underwriters in municipalities equipped with motor-driven fire apparatus. Extraordinary maximum speeds are not needed even in fire department motor-truck service, and a machine capable of running 20 or 25 miles per hour represents adequate protection. The pioneer work at Springfield, Mass., described in this paper in the issues of July 22, 1911, page 202, and Dec. 16, 1911, page 1492, has attracted world-wide attention, and the installation has already been visited by 1300 chiefs of departments from widely separated localities.

RESEARCH WORK AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Mr. H. F. Thomson, special research assistant in the electrical engineering department of the Massachusetts Institute of Technology, then gave an informal talk upon the progress of the investigations of horse and motor transportation being carried on at that place under the auspices of the Boston Edison company, and presented the accompanying diagram of total expense of operating a 1000-lb. parcel, a 4000-lb. furniture, a 7000-lb. beer and a 10,000-lb. coal delivery service by horse, gasoline and electric propulsion. The data now being analyzed at the Institute for later deductions are based upon actual field costs taken from the records of concerns located in the territory between Boston and St. Louis. The figures from which the accompanying

curves were plotted include all fixed and operating charges and show a substantial economy in the use of the electric truck within its field of action. In the case of the coal delivery, for example, the service in a nine-hour day covers 28 miles in case of the electrical equipment, 30 miles with the gasoline and 19 with horses. The loading time was determined as 0.2 hour and the unloading time was taken as 0.7 hour. A three-horse wagon with two extra horses was required, and the average length of haul was 3 miles, or 6 miles per round trip. The total cost of the coal-hauling service was 45 cents per truck-mile for the electrical outfit, 51 cents for gasoline delivery and 59.5 cents for horse haulage. Mr. Thomson said that within a few months the Massachusetts Institute hopes to have analyzed enough operating data from actual service to furnish a basis for predetermination of costs with fair accuracy. Over 100,000 observations have now been made upon the speed-time performance of transportation equipment, and the importance of keeping trucks in motion has been found to be a vital factor in the success under competitive conditions. The average speed of gasoline trucks on the street is much lower than is ordinarily supposed, and the electric vehicle suffers little because of the higher speed characteristics of such equipment. The rising price of gasoline and horses favors the installation of electric trucks. The latter have made a splendid showing in view of the fact that there are now 240 gasoline truck manufacturers in business in this country compared with thirty-seven builders of electric trucks. Other speakers were Mr. F. M. Kimball, of the General Electric Company; Mr. E. S. Mansfield, of the Boston Edison company, and Mr. C. C. Pillsbury, of the Westinghouse Electric & Manufacturing Company, Boston. Mr. Kimball, as chairman of the New England Section of the Electric Vehicle Association of America, urged the publication of comparative operating data of a comprehensive kind in terms understandable to the average business man. He stated that orders for electric vehicle accessories are increasing at a surprising rate and voiced his impressions regarding the stability and growth of the electric truck business throughout the country. Mr. Mansfield suggested the possibilities of a closer affiliation with the national organization.

ELECTRICAL PROGRESS IN NEW ZEALAND.

The Dominion of New Zealand, with a population in 1910 of slightly over 1,000,000 inhabitants, imported in the same year goods from other countries to the value of $81,505,227, in which are included purchases in the United States having a value of $6,811,820. In Special Consular Report No. 57, on the resources, industries and trade of New Zealand, prepared by Mr. Henry D. Baker and recently distributed by the United States Bureau of Foreign and Domestic Commerce, there is considerable information relating to electrical progress in that country, from which the following is taken.

Electricity has numerous popular uses in New Zealand, such as for lighting, heating, cooking and ironing, and is used industrially in a great variety of ways, the most interesting of which are for shearing sheep and milking cows. The demand for small motors, and in fact for all kinds of appliances, lamp ware, etc., is important, but unfortunately American manufacturers participate to a limited extent in such trade and English competitors control the greater part of it.

Wellington, Auckland and Dunedin, three of the leading cities of New Zealand, have electric plants furnishing energy for those who desire to use it, and in these cities, especially Wellington, which was the first to get the benefit of cheap electricity, the sale of such appliances appears to be steadily increasing. In many of the smaller towns, and even at isolated butter factories and sheep and dairy farms, where water-power is accessible and cheaply developed, many electrical appliances are in use. While water-power has not been utilized on so large a scale as in the United States, and the use of electric energy for big manufacturing operations is unknown, yet electricity has perhaps had wider and more interesting applications than in America, and perhaps plays a more important part in domestic economy, especially in country districts, where electricity when not obtainable from water-power is generated by oil or steam engines. The remarkable increase in the use of milking machines and the substitution of modern machine shearing for the old system of shearing sheep by hand have caused an ever-increasing demand for equipment, especially for motors of about 6 hp. Once such equipment is installed on a farm or station it is also used for lighting, heating, sawing wood, etc. In different towns of New Zealand, especially Wellington and Dunedin, there are many small shops dealing in electrical appliances and making attractive displays of such wares in their windows.

The electrification of the railways in certain sections is now under contemplation by the government, especially where there are long tunnels, such as the one between Christchurch and Lyttelton, now the longest in the Dominion (1¼ miles long), at the Otira Tunnel, and at the Rimutaka incline, between Wellington and Napier in the North Island, where there is a grade averaging 1 ft. in every 3 ft., requiring two or three engines for hauling trains up the incline.

Being a well-watered and mountainous country, it is rich in water-power resources. According to statistics for 1910, supplied by the machinery department of the government, the total development of water-power in New Zealand is only 19,353 hp. This represents only 9.5 per cent of the total present power supply (exclusive of railways) in New Zealand, amounting to 204,458 hp, of which 150,-137 hp, or 73.4 per cent, is suplied by steam engines, 23,456 hp, or 11.5 per cent, by gas engines, and 11,512 hp, or 5.6 per cent, by oil engines.

It is evident that there is considerable scope for the employment of cheap water-power as a substitute for that now generated by steam, gas, and oil engines. It is estimated, however, that about 30,000 hp generated by steam engines in saw mills and flax mills would probably not be changed from steam to water-power, as the sawmills have fuel available in their shavings and off-cuts and the flax mills are generally in remote spots and not of a permanent nature. Altogether it is considered possible to develop profitably about 150,000 hp for the present industrial needs of the country, without considering the possibility of further use of energy by the government railways, which might in time use electricity developed from water-power instead of steam.

The most important water-power plant in the country is at Waipori, and it develops 5330 hp, which is transmitted 30 miles to the city of Dunedin. The remainder of the 19,353 hp developed in New Zealand is from small plants scattered over the country and is used chiefly for mining purposes, especially at Waihi in the northern part of the North Island, and for various butter factories, etc., which develop power from near-by streams.

The rather slow utilization of water-power in a country where it is so plentiful is due chiefly to popular objection to private exploitation and the desire that all water-power should be owned, controlled and developed by the government itself. The Dominion government and also the various municipal bodies that might undertake such development have, perhaps, been more cautious in assuming the financial risks involved than private companies would have been. Consequently, until the action of the Dominion Parliament last year in making provision for the expenditure of $2,433,250, little serious action had been taken, except as to the surveying of possible sites.

Among the larger proposed hydroelectric developments is one at Lake Coleridge, of 14,000 hp, which is very favorably situated for water storage, inasmuch as the lake has an area of 14 sq. miles. The energy will be transmited, according to the plans, to Christchurch, 70 miles distant. This project was described at length in our issue of May 11, 1912. Next in importance is a proposed development on the upper Hutt River, of about 17,000 hp, for the benefit of Wellington and other towns in the vicinity, requiring a 31-mile transmission. The Lake Coleridge plant would operate with a 470-ft. head and the latter with a 285-ft. head. Another scheme contemplates a large development at Lake Rotoiti in the hot-springs district, with a 170-mile transmission to Auckland, delivering 26,000 hp. Several other projects of a more ambitious character have been proposed, but are not seriously considered at present and are not likely to be until the population increases.

The demand for electricity for industrial purposes, such as for factories, mining, tramways and street lighting, and for domestic lighting, heating and cooking, is increasing constantly. The public has become so educated to the use of electricity that the need for its cheap development by water-power is well recognized by the government authorities, who now feel that, unless they are prepared to permit private capital to establish water-power works, they can no longer refrain from committing themselves to the necessary expenditures and risks.

At present 1,320,000 kw-hr. of electricity are sold annually for electric lighting in Wellington, 742,000 kw-hr. in Dunedin and 369,620 kw-hr. in Christchurch. In Auckland electric lighting has just been introduced. In all of these cities except Dunedin electricity is now produced from coal.

Electric street lighting is already fairly well developed in Wellington and Dunedin, 562,000 kw-hr. being used last year in Wellington and 102,000 kw-hr. in Dunedin. In Auckland one road has been successfully lighted with flame-arc lamps, and no doubt the system will be extended to all the main thoroughfares. In Christchurch street lighting by electricity has not yet been attempted, except for a few arc lamps maintained at the tramway stopping places. The Minister of Public Works estimates that within the next five years, owing to the introduction of cheap electric energy, Wellington will have 190 miles of streets lighted with 220 arc lamps and 2000 incandescent lamps; Auckland, 150 miles lighted with 200 arc lamps and 500 incandescent lamps; Christchurch, 170 miles lighted with 220 arc lamps and 400 incandescent lamps, and Dunedin, 180 miles lighted with 240 arc lamps and 600 incandescent lamps.

It is estimated that within five years' time there will be 4200 electric stoves and heaters used in Wellington, 3200 in Auckland, 3100 in Christchurch and 3200 in Dunedin.

Among the electrochemical industries suggested for New Zealand in connection with the development of its water-power is the manufacture of calcium carbide, the imports of which are increasing each year, having been 898 tons in 1907, 932 tons in 1908 and 1667 tons in 1909. The local manufacture of this article would be favored by the fact that the freight rate on it from Europe to New Zealand and Australia is very heavy. Probably of still greater importance to New Zealand is the possibility of electric smelting of iron and steel, as the country is fortunate in having iron-ore deposits, and the necessary limestone flux, within easy reach of water-power.

PATENT LEGISLATION IN NEW ZEALAND.

The Parliament of New Zealand passed a new act relating to patents, designs and trade-marks which took effect in July and differed from the old act chiefly by the insertion of a provision that any patent not worked in New Zealand within four years of the date of issue, or within two years after the commencement of the new act, may be revoked by the Supreme Court on petition of the Attorney General or any other person having his permission. The new patent legislation of New Zealand is generally along the lines of the English act except that the requirement of the latter in reference to the working of patents has been omitted. The provision inserted in its place was patterned after a similar provision in the Australian act.

The Minister of Railways, who introduced the new bill in the New Zealand Parliament, made a speech in explanation of it, from which the following is taken: The law in regard to patents has been materially altered in all portions of the world during the past few years. The present act is consistent with the desire for uniformity of legislation throughout the British Empire. Some years ago the countries of the Continent of Europe commenced to enact laws which nullified a patent granted in the particular country if it was not worked in that country within a specified number of years, and this was found materially to affect the business of Great Britain. In 1907 Great Britain passed an act on similar lines, under which no patent will hold good in that country unless worked there within a given period. The new Australian act was passed a year later. Under the terms of the new act, if a New Zealand patent is not worked in that country within four years after it is granted it may be revoked. But a foreign patentee is adequately protected by reason of the fact that if he desires to work the patent he may arrange with a New Zealand manufacturer to take it up.

It is somewhat anomalous to think that any country should grant an inventor, for nothing, a monopoly of something which may materially hinder the progress of an industry in that country; but such was the effect of the former patent law of New Zealand. The effect of the new English act is said to have been such that within one year over $5,000,000 was invested in Great Britain in industries which were protected by English patents. There are now about 3800 patents in force in New Zealand and about 1700 applications pending. During 1910 about 150 applications were filed by residents of the United Kingdom, 258 from Australia, 120 from the United States, 15 from Germany and 23 from other European countries.

PRESIDENT TAFT ON OUR EXPORT TRADE.

Last week President Taft sent to Congress, just reassembled for the short session, a special message dealing with our foreign trade. He declared that the position of the United States in the moral, intellectual and material relations of the family of nations should be of vital interest to us all. The tremendous growth of the export trade of the United States has already made that trade a very real factor in the industrial and commercial prosperity of the country. The fundamental foreign policies of the nation, said Mr. Taft, should be raised high above the conflict of partisanship and wholly dissociated from differences as to domestic policy.

The President in effect characterized diplomacy as the handmaid of trade. Under the present administration he said it has been the policy to place our diplomatic relations in sympathy with modern ideas of commercial intercourse. This policy has been characterized as substituting dollars for bullets. A high tribute was paid in the message to our diplomatic and consular service, and a recommendation was made for an increased appropriation in order to extend its work and increase our foreign prestige. There is need, said the President, for additional legislation enabling the chief executive to apply to any or all commodities of a country which discriminates against the United States a graduated scale of duties up to the maximum of 25 per cent *ad valorem*

provided under the present law. Flat tariffs, said Mr. Taft, are out of date, and nations no longer accord equal tariff treatment to each other irrespective of the treatment received. Such a flexible power would serve to moderate any unfavorable tendency on the part of countries from which importations into the United States are substantially confined to articles on the free list, as well as on the part of the countries which find lucrative markets in the United States for their products under existing tariffs. The President believes that the American government should be equipped with weapons of negotiation adapted to modern economic conditions.

In President Taft's last annual message he remarked that the fiscal year ended June 30, 1911, was noteworthy as marking the highest record of exports of American products to foreign countries. The fiscal year of 1912 shows that this rate of advance has been maintained, for the total domestic exports had a valuation of approximately $2,200,000,000 as compared with a fraction over $2,000,000,000 for the previous year. During the fiscal year of 1911 the export of articles in the various stages of manufacture, not including foodstuffs partly or wholly manufactured, amounted to approximately $907,500,000, the growth to the sum of $1,022,000,000 for the fiscal year 1912 representing a gain of $114,000,000.

The President devoted considerable space in the message to our harmonious relations with the other nations of the world and the peaceable and friendly settlement of such differences as have arisen on occasion. Congress should fully realize, said the President, the conditions which obtain in the world as we find ourselves on the threshold of our middle age as a nation. In his own words: "We have emerged full grown as a peer in the great concourse of nations." The successful conduct of our foreign relations demands a broad and modern view. The opening of the Panama Canal will mark a new era in our international life and create new and world-wide conditions which will persist for hundreds of years to come. In closing, the President said: "With continuity of purpose, we must deal with the problem of our external relations by a democracy modern, resourceful, magnanimous and fittingly expressive of the high ideals of a great nation."

REPORT OF PATENT OFFICE INVESTIGATION BY ECONOMY AND EFFICIENCY COMMISSION.

By a joint resolution approved Aug. 21, 1912, Congress requested the President to cause an investigation of the Patent Office to be made by the President's Commission on Economy and Efficiency. The resolution directed that the commission should investigate fully and carefully the administration of the Patent Office with a view of determining whether or not its present methods, personnel, equipment and building were adequate for the performance of its functions. A report with specific recommendations as to what changes in law, what increases in appropriations and what additional building accommodations may be necessary to make the Patent Office more efficient and economical was required to be made by Dec. 10. It was further directed that recommendations should be made as to what extent any expenditures recommended should be met by increases of Patent Office fees. This report has been completed and was transmitted to Congress by President Taft on Dec. 9. It is a formidable document of 1100 typewritten pages. An abstract of it follows:

NEW BUILDING NEEDED

The report recommends that a new building, especially designed, equipped and furnished, be constructed on a suitable site in the city of Washington for the exclusive use of the Patent Office The commission reports that the space in the present building is wholly inadequate for the efficient and economical transaction of business; that the rooms are crowded and poorly lighted and ventilated. It says that some of the rooms, made by partitioning off the old hall formerly used to exhibit models, have ceilings only 8 ft. high, and with the large number of persons employed in a room of this kind the absence of adequate ventilation causes a serious loss in efficiency and injures the health of employees. The danger of fire is commented upon, as the records of title to patents and other papers of value are exposed to loss by fire, being stored in wooden boxes. The halls and corridors are used for files. Examiners are so crowded that careful work cannot be expected. The commission concludes that substantial improvement in the work of the Patent Office must wait upon provision being made for a suitable building, adequate for the needs of the office and especially equipped with reference to the nature of the work.

An appropriation is recommended for the repair of the rooms occupied by the Patent Office, for the installation of suitable lighting and ventilating facilities and for the purchase of new furniture and equipment. It is suggested that the urgent need for more room be met temporarily by moving some divisions of the Interior Department from the present building and giving the space to the Patent Office.

INCREASE OF FORCE AND SALARIES.

It is recommended that the number of employees in the office be increased from 939 to 975, with an increase in the pay roll of $236,550. The principal salary increases recommended are for the commissioner, from $5,000 to $7,500; for an assistant commissioner, from $4,500 to $5,000; examiners-in-chief, from $3,500 to $4,500; examiner of classification, from $3,600 to $4,000; examiner of interferences, from $2,700 to $3,600; principal examiners, from $2,700 to $3,600; first assistant examiner, from $2,400 to $2,700; second assistant examiners, from $2,100 to $2,250. A force of seven supervising examiners to aid the Commissioner of Patents in the administrative work of the office is recommended at salaries of $4,000 each. The increase in force recommended, in addition to the supervising examiners, is two examiners-in-chief at $4,500 to make the board consist of five instead of three members; one additional examiner of interference at $3,600; one assistant to chief of division of trade marks at $2,700; one assistant to chief of classification division at $3,000; twenty-seven additional first assistant examiners at $2,700; seventeen additional second assistant examiners at $2,250; six additional third assistant examiners at $1,800, and the reduction of the number of fourth assistant examiners from 110 to 83. In the clerical force the following changes are recommended: Thirteen additional clerks at $1,400; twenty additional clerks at $1,200; ten additional clerks at $1,000; seventeen additional clerks at $900. This recommendation would eliminate fifty clerks at $720 in the provision for an additional number at the higher grades. Messenger boys engaged in collecting copies of patents, of which nearly 11,000 copies a day are sold, are recommended for increase from $360 to $480. The present pay roll of the office is $1,311,010. The proposed pay roll will be $1,547,560.

ADMINISTRATION OF THE OFFICE.

The report recommends that the Commissioner of Patents be relieved from the duty of considering cases on appeal from the board of examiners-in-chief and from the division of trade marks, in order that he may give his entire attention to the administrative work of the office, and that he be assisted in the administrative work by one assistant commissioner of patents and seven supervising examiners. It is pointed out that adequate control of the methods and procedure of the forty-three examining divisions in the allowance and rejection of applications for patents is necessary to secure efficient work. The commission bases the recommendation that the Commissioner of Patents be relieved from judicial work upon the fact that the number

of invalid patents issued is due largely to a failure to supervise and control the work of the examining force, leaving the decision on applications to the forty-three principal examiners. Their decisions if favorable to the issue of patents are not reviewed. If unfavorable, the applicant can appeal. The commission believes that if the Commissioner of Patents were relieved from deciding individual cases and had the aid of seven supervising examiners he could prevent almost entirely the issue of patents which would not be allowed if the commissioner had the time and assistance necessary for supervising the work of examiners.

The commission reaches the conclusion that the defects in the organization and procedure of the Patent Office result in a lack of uniformity in the work of the examining divisions. These defects are due to the organization remaining the same as it was fifty years ago, when the business of the office and the force of examiners were very small as compared to the conditions at the present time. With a corps of examiners numbering nearly 400, it is impossible for the Commissioner of Patents, with his present duties of deciding cases on appeal, to give the administrative work of the office the attention that is essential.

ABOLISH ONE APPEAL IN THE OFFICE.

Frequent complaint has been made by inventors and others having business with the Patent Office that the number of appeals within the office in contested cases is more than is necessary and results in delay and expense to inventors. The commission has recommended that instead of an appeal to the board of examiners-in-chief and a second appeal to the Commissioner of Patents, the board be increased from three to five members and all appeals within the office be taken to this board, thus eliminating the one appeal to the Commissioner of Patents. This plan would allow the appeal that may now be taken from the decision of the commissioner to the Court of Appeals of the District of Columbia to be taken from the board of examiners-in-chief, whose decision would be the decision of the Patent Office.

INCREASE OF PATENT OFFICE FEES.

The commission recommends that the fee for filing an application for a patent be increased from $15 to $20, and supports its recommendation by the statement that the fee of $15 is too small to warrant the necessary time being given to the examination of an application. It expresses the opinion that a reasonable increase of fees is justified when the service rendered is improved. This change in fee, it is estimated, will increase the annual revenues of the Patent Office $200,000. It is estimated that the total revenues of the office, which now show a small surplus, will equal the proposed expenditures, including the increases in force and salaries recommended.

TERM OF THE PATENT.

An important recommendation is that the life of a patent be so limited as to expire nineteen years from the date of filing the application, excluding the time, not exceeding two years, during which an application may be involved in interference. The commission reports that under the law which allows an applicant one year's time in which to answer any action of the Patent Office there have been many applications kept pending in the Patent Office for ten years or more. As the present law provides that a grant of a patent shall be for seventeen years from the date of issue, it is possible, under the present practice, for an inventor to extend the life of his monopoly beyond seventeen years. The commission believes that the remedy is to make the term of the patent commence from the date of filing the application, as is done in foreign countries. It is also believed that a reasonable period of time, which it suggests be two years, be allowed in addition to the nineteen years for the time an application may be involved in interference proceedings which are instituted by the Patent Office and not by the applicant.

FACILITIES FOR EXAMINING APPLICATIONS.

The commission reviews at some length the work of reclassifying patents and digesting printed publications as an aid to determining quickly and accurately whether an applicant is entitled to a patent, which work has been in progress for some years. It urges an appropriation for an adequate force to complete this work within five years and emphasizes the importance of providing the best facilities for simplifying and making more accurate the search by examiners in order that the number of invalid patents may be reduced.

THE OFFICIAL GAZETTE.

Raising the subscription price of the *Official Gazette* from $5 to $10 is recommended and a change in the method of distributing copies of this publication to libraries is suggested. The distribution is now made to the eight libraries in each Congressional district that may be designated by the member of Congress. It is recommended also that instead of publishing in the *Gazette* the first five claims of a patent a brief or summary of the patent be published so as to give a better idea of the patent and reduce the size of the *Gazette*.

PRINTING TO BE DONE AT GOVERNMENT PRINTING OFFICE.

It is recommended that all the work of producing the publications of the Patent Office be turned over to the Government Printing Office and that that office be equipped to handle the work. Part of it is now done at the Government Printing Office and a part through contractors.

SUBJECTS NOT REPORTED ON.

In concluding its report the commission refers to several subjects upon which it was not authorized to make recommendations, such as the proposal to create a United States Court of Patent Appeals to have the jurisdiction in patent causes now exercised by the circuit courts of appeals in the nine circuits of the United States. It reports that the creation of this court is favored by practically all the attorneys interested in patent causes and by inventors generally. For the reason that the subjects did not come within the scope of its investigation the commission states that it makes no recommendations concerning litigation in the courts nor with reference to the suggestion that has been made to create a patent bar and to require that a person be a member thereof before being authorized to practise before the Patent Office.

THE PATENT MONOPOLY.

Although it makes no recommendation upon the subject of the extent of the monopoly granted by a patent or the question of compelling a patentee to work his patent or grant a license to others to do so, the commission sets forth in an appendix the law and procedure of Germany and England on these subjects, with papers discussing the patent systems of other nations.

IMPROVING THE PATENT SYSTEM.

After a review of the history of the United States patent system the commission concludes that the remedy for the evil of granting invalid patents is not to be found in a departure from the plan of granting a patent only after examination but in perfecting the examination system established seventy-six years ago and afterward adopted by other nations. The great development of our patent system, as shown by the filing of 70,000 applications a year and the grant of 33,000 patents, has made inadequate, say the commission, the organization and procedure of the Patent Office, as well as the procedure in the courts. The commission expresses the opinion that to meet the conditions which cause complaint it will be necessary to build up the Patent Office so as to justify making its decision final on many questions and not allow every question concerning the validity of a patent to be litigated in the courts. Then a patent will be more than a preliminary to a lawsuit, where often the victory rests with the one who can best bear the expense.

TRIAL OF PATENT CAUSES AFFECTED BY NEW RULES OF EQUITY PRACTICE.

The Supreme Court of the United States has for some time past had under consideration the revision of rules of practice in the equity courts of the United States, in order to correct some of the abuses which have grown up under the present rules and to expedite the administration of justice. After long consideration, the Supreme Court has recently promulgated a new set of rules governing practice in the United States courts of equity, which will be in force on and after Feb. 1. Much has been done to shorten the trial of equity causes and to diminish the amount of legal quibbling over technicalities and immaterial points which has been such a prominent feature in the trial of patent cases.

The former practice of allowing much testimony to be taken before masters or referees will be changed, and in all trials in equity testimony of witnesses will be taken orally in open court before a judge, except in certain cases referred to later. The court will also pass upon the admissibility of all evidence offered, as in actions at law. Where there is exceptional cause for departing from this general rule and the statutes permit it, testimony may be taken by deposition or before a master. But in any such instance the depositions of the plaintiff must be taken and filed within sixty days from the time the case is at issue, and those of the defendant within the next thirty days after the expiration of the plaintiff's period. Depositions in rebuttal by either party must be filed within twenty days after the time for taking the original depositions expires.

In a case involving the validity or scope of a patent or trade-mark the District Court may, upon petition, order that the testimony in chief of expert witnesses, which is directed to matters of opinion, be set forth in affidavits. The plaintiff's affidavits must be filed within forty days after the cause is at issue, and those of the defendant within twenty days after the plaintiff's time has expired. Fifteen days after the expiration of the time limit for both original affidavits is provided for the filing or rebutting affidavits. Cross-examination or re-examination of affiants must take place before the court. The evidence offered before an examiner or like officer must be saved and turned over to the court.

After the time has elapsed for filing depositions, the case shall be placed on the trial calendar, and thereafter no other testimony by deposition shall be taken except for some strong reason shown by affidavit. After a case is placed on the trial calendar it may be passed over to another day of the same term of court by consent of counsel or order of the court, but shall not be continued beyond that term save in exceptional cases and upon good cause. If a case is dropped from the trial calendar, it must be reinstated within one year by the application of either party, and then heard at the earliest convenient day, or the suit will be dismissed without prejudice to a new one.

Each party is allowed twenty-one days in which to file interrogatories, but neither party shall file more than one set without permission of the court. Answers to interrogatories are required within fifteen days after they have been served, except by permission of the court. The reference of an equity case to a master will be the exception and not the rule, save in cases where an accounting is to be rendered. In such instances it will be the duty of the master to expedite the hearings and return his report to the court promptly. The master is to have full power to regulate all the proceedings in every hearing before him. After the master's report is filed with the court each party will be allowed twenty days within which to file exceptions, and if none is filed within that time the report will stand confirmed. But when exceptions are filed they shall stand for hearing before the court, if then in session, or if not, at the next sitting held thereafter.

Probably one of the most important reforms thus effected is the abolition of the practice of taking expert testimony before masters or examiners. As is well known, such hearings have been dragged out to an interminable length without good cause, and the burden has fallen heavily on the litigant of limited means. There is cause for congratulation, also, in the fact that hereafter the way of the procrastinator will be made hard.

NATIONAL CIVIC FEDERATION'S INVESTIGATION OF PUBLIC UTILITY LAWS.

For nearly a year past the National Civic Federation has been conducting an investigation of the regulation of public service companies under federal, state and municipal laws. The scope of the work includes a compilation of regulatory laws, analyzed and annotated; the formulation of a model public utilities bill; the preparation of a special report on regulation of capitalization, sliding scale and profit-sharing, and a study of state versus municipal regulation. In framing a model public utility law committees on the following subjects have been at work: accounts and reports, capitalization, form, franchises, rates, safety of operation, and service. The investigation as a whole has been directed toward the problem of determining what constitutes adequate regulation of public utilities and to what extent it is desirable or necessary for the state to go in regulating the service and charges of railroads, electric, gas, telephone, telegraph, water and other utilities in order to protect and conserve the rights of consumers, the public and the companies. In connection with the work many court and commission decisions have been abstracted and digested. The investigation is nearing completion and a report will probably be ready at an early date. This entire work has been in the special charge of the department on regulation of public utilities, of which Mr. Emerson McMillin is chairman. Prof. John H. Gray, of the University of Minnesota, has been in direct charge, and has been assisted by Mr. William B. Kerr, of Chicago, and Prof. Bruce Wyman, of Harvard University.

COMMENT ON PUBLIC SERVICE COMMISSION AFFAIRS IN NEW YORK FIRST DISTRICT.

At a time when the subject of commission regulation of public utilities is being so generally studied and discussed, there is considerable interest in the status of the Public Service Commission for the First District of New York, which was very frankly discussed in a recent article in the New York *Evening Post*. The term of Chairman William R. Willcox will expire on Feb. 1 and there is much conjecture as to whom Governor-elect Sulzer will appoint in his place. The *Post* hints that the situation is critical and reports recent signs of political activity in the commission. The query is naturally as to whether an unusually capable and faithful public servant will be succeeded by an equally able and experienced appointee, or whether the appointment will fall under the political spoils system to an incumbent whose chief qualification will be the indorsement of the local political leader. It will be very widely admitted that the success or failure of commission regulation depends fundamentally upon the character, integrity and ability of the appointees to office in the regulating body.

Under appointment from former Governor Hughes, who fathered the public service commission law, the members of the first commission took office on July 1, 1907. The personnel was as follows: Chairman, Mr. William R. Willcox; commissioners, Messrs. William McCarroll, Edward M. Bassett, Milo R. Maltbie and John E. Eustis. The *Post* said of these appointments:

"Willcox had been park commissioner in Mayor Low's administration and later postmaster of New York City; McCarroll was a business man, president of the American Leather Company and one-time president of the New York Board of Trade; Bassett had been a member of the Democratic general committee in Brooklyn and a member of Congress, and was a warm personal friend of Hughes; Maltbie was known as an expert on municipal affairs, with no political affiliations whatever; Eustis had been a member of the Board of Education, and was commissioner of parks for the Bronx under Mayor Low."

When the terms of Messrs. Eustis and Maltbie expired, in 1909 and 1910 respectively, Governor Hughes reappointed them each for five years. When Commissioner Bassett's term expired in 1911, Governor Dix, who had succeeded Governor Hughes, appointed Mr. J. Sergeant Cram to the place. Commissioner Carroll's term expired early this year, and although the Legislature refused to sanction the Governor's first choice for the position, he finally succeeded in appointing Mr. George V. S. Williams. Both of these appointments have been criticised as violating the spirit of civil service and lowering the standard of the commission.

Attention has also been drawn, as a possible motive for desiring to have a commission which will be friendly to certain interests or organizations, to the unlet subway contracts for $277,000,000 which will soon be awarded and the $125,000 annual salary list of some thirty-two subordinates whose positions are not protected by civil-service rules. Under the administration of the original appointees of Governor Hughes, an efficient non-partisan organization was built up and the commission gained a national reputation of high order as the result of its work.

That there is need of vigilance in upholding the high standards previously established in the commission's work is indicated by the unusual and somewhat astonishing character of portions of Vol. IV of the annual report for 1910, covering statistics of gas and electric companies. The section on "Load Factors and Rates" is particularly in evidence. This portion of the report, which occupies twenty-eight pages, is characterized at many points by a style of discussion which reveals no intimate knowledge of the central-station industry. In all fairness to the members of the commission it is proper to point out that this portion of their report is virtually an appendix and was compiled by the Bureau of Statistics and Accounts.

The following quotation, taken from the report in reference to the general subject of load-factors, is an example of some of the statements: "Breakdown and periodical overhaulings [of machinery] could be largely reduced or the stoppage and delay incident to them done away with if intervals of reduced utilization were not inevitable. They could be provided for statistically by distinguishing between the rated capacity of a plant and its actual working capacity for a given period." Another interesting statement is this: "Load-factors are of special interest wherever the commercial product is a *service* rather than a material good." Continuing further on, the report says: "Steadiness of demand, and therefore the load-factor, is also important in relation to losses in distribution." The general statement is also made without qualification that "One-third of the electricity generated may be 'unaccounted for.'" At another point a statement is made that economy requires producing units to be of large capacity, the tendency being toward still larger sizes. This, according to the report, makes it impossible closely to adjust capacity to demand except rarely and temporarily. No reference is made to the practice of subdividing central-station generating units in order that the load at all times may be handled on an economical basis. The remarkable statement is also made that connected load is of significance for motor loads rather than for lighting customers, but the reason for this view is not stated. Another definition which excites comment is the following: "The diversity factor measures the difference in time of the maximum of different classes of business." The Doherty rate system is attacked and a number of things are said of it which may be regarded as covering ground which at least is debatable. Probably the most amazing statement made in the whole report is that next given: "From the viewpoint of public policy in relation to fire risk, too, the general use of gas is probably as yet to be preferred, not only to kerosene, but also to electricity." The statistical portion of the report is extremely voluminous, and it is difficult to understand the value or purpose of some of the extremely elaborate tabulations, particularly those which classify employees according to the number of days employed each week, whether paid by the hour or by the day, etc., with the classification carried through the year week by week.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

The Public Service Commission for the First District has requested the Board of Estimate and Apportionment to make an appropriation of $1,763,000 for the expenses of the commission for the year 1913. The commission's budget for the year 1912 was $1,554,500. While the commission for the First District is a State commission, the State pays only the salaries of the commissioners, the counsel and secretary, and all the other expenses are paid by the city of New York. The bulk of these expenses is incurred for rapid-transit work, which will take more than $1,300,000 of the total budget for 1913. The increase over the year 1912 is due entirely to the increased expenses due to work on the new system of subways. Part of this money will be returned to the city in future years, for the operating contracts for the new subways, as prepared by the commission, will include the engineering expenses of the commission as part of the cost of construction, and a sinking fund will be provided to amortize this cost out of the earnings during the life of the operating lease.

The commission has modified the orders issued by it last February requiring the New York Railways Company and the Third Avenue Railway Company to set aside each year a specified amount of money as an amortization fund to make up the difference between the value of the property and the securities issued by the companies in their respective plans of reorganization, and also providing for the setting aside each year of 20 per cent of the gross earnings as a depreciation fund. In the case of the New York Railways Company the amount ordered set aside for amortization was $108,000 each year plus 4 per cent upon all prior payments until the fund shall amount to $16,500,000. In the case of the Third Avenue Railway Company the amount to be set aside for amortization was $180,000 plus 4 per cent upon all prior payments until the fund shall amount to $25,000,000. These amounts of $16,500,000 in the case of the New York Railways Company and $25,000,000 in the case of the Third Avenue Railway Company were the sums respectively, the commission held, by which the proposed security issues exceeded the value of the property.

The new orders issued modified the previous orders by canceling the requirement for the establishment of this amortization fund in the case of each company, on the ground that under the law as it then stood the commission, while satisfied of the necessity for providing such amortization funds, was not warranted in ordering the companies to provide them. The commission finds, however, that it had authority to order the setting aside of 20 per cent of the gross earnings as a depreciation fund and this part of the order is allowed to stand.

NEW YORK COMMISSION, SECOND DISTRICT.

The Public Service Commission for the Second District has directed its counsel to commence an action against the Oswego River Power Transmission Company by a man-

damus or injunction to prevent it from continuing the furnishing of electricity for motor-service purposes to certain manufacturing establishments in the city of Fulton. The Fulton Light, Heat & Power Company, which is now operating in Fulton, complained to the commission that the Oswego River Power Transmission Company had a permit granted to it by the Superintendent of Public Works to erect poles and string wires along the bank of the Oswego Canal in the city of Fulton and is serving electricity for industrial purposes to certain manufacturing establishments in that city. The commission has held that the permit constitutes a franchise and that the Oswego River Company is at the present time exercising such franchise without the permission of the commission. The Oswego River Company claims that it has constructed its pole line and strung the wires in good faith, believing that it is not obliged to apply to the commission for permission to exercise its rights under this permit.

MASSACHUSETTS COMMISSION.

The Gas and Electric Light Commission has received a petition from the Central Massachusetts Electric Company appealing from an order of the Palmer Selectmen granting a location for a transmission line to the Warren Power Company. The petitioner avers that it is occupying the local electric-service field and objects to the entrance of a competitive company. A similar appeal has been lodged with the board in connection with a franchise granted the Connecticut River Transmission Company by the Selectmen of Enfield. Hearing dates will be assigned by the commission. Consumers of the Lawrence Gas Company have petitioned the board for a reduction in the price of gas to 80 cents.

NEW JERSEY COMMISSION.

The Board of Public Utility Commissioners has denied that the New Jersey Gas Company possesses the right to establish a minimum bill. Complaints were made to the board by the borough of Elmer and others that the New Jersey Gas Company was, by the ordinance granting a franchise to the company it succeeded, restricted to a charge which was not to exceed $1.50 per 1000 cu. ft. with a discount of 8 per cent to be allowed on all bills paid within fifteen days after presentation. The company established a monthly charge of 50 cents, to be paid whether enough gas was consumed at the regular rate to equal this amount or not. The company contended that this did not violate the ordinance, in that the minimum monthly charge of 50 cents was not for gas furnished but for being in readiness to supply gas. This construction of the ordinance was not accepted by the board. In its finding in this matter the board expressed the opinion that a reasonable minimum charge is proper, provided the company has not contracted itself out of the right to include such a minimum charge in the price it sets for gas; but in this case the company had contracted itself out of such right.

MARYLAND COMMISSION.

The Maryland Public Service Commission has received a supplemental brief which was filed by Mr. Albert C. Ritchie, people's counsel in the Baltimore rate hearing. It contained largely a criticism of the statement made by Mr. J. E. Aldred, president of the Consolidated Gas, Electric Light & Power Company, at the close of the argument in the hearing before the Public Service Commission. That Mr. Aldred is mistaken in many of his deductions Mr. Ritchie undertakes to show in two ways, first, by admissions he said were made by Mr. Aldred's own company in the course of the hearing and, second, by liberal quotations from the report of the St. Louis Public Service Commission in a very recent case. Mr. Ritchie's principal attack, in this supplemental brief, was directed toward the gas and electric consolidation of 1905 and 1906, which he said was made at a time when "no company was acting as a club on the existing companies and no change whatever in ownership resulted. The admitted inflation in the par value of bonds alone has been $9,672,000, of which $7,102,000 were the result of the 1905-6 consolidation." Mr. Ritchie concludes that the Baltimore public certainly should not be required to pay dividends on this "water." He said that Mr. Aldred proceeded, among other things, to attribute the company's large capitalization to "the mistaken policy of the people" in permitting competition, and that in the light of fairness and equity it is impossible to consider putting upon the present company and its shareholders the burden which has resulted from the mistaken policy in the past. Mr. Ritchie said that the complainant's brief shows conclusively that the principal capital inflation occurred in 1905 and 1906, when the syndicate, composed of leading New York and Baltimore financiers, issued to itself securities having a par value of $19,762,088 in exchange for old securities having a par value of $13,123,018, which had cost not more than $10,225,554 and which represented a maximum investment of not more than $3,131,117. The excess of new par value over maximum investment was thus $16,630,971, which is sufficient to cover all of the preferred and common stock and $2,470,883 of the general-mortgage bonds, the interest and dividend charges on these watered securities amounting to $882,795 every year.

Mr. Ritchie said that on Nov. 19, 1912, the St. Louis Public Service Commission made an exhaustive report to the Municipal Assembly of St. Louis upon the United Railways Company of that city. A copy of this report is submitted to the Maryland commission. The St. Louis Company's capitalization is $101,380,300, but the commission found that the fair value of its property devoted to the public service was only $37,638,668, and that a fair return on this was 6 per cent. The commission, therefore, found that the company's capitalization exceeded the fair value of the property by the enormous sum of $63,741,632. In this connection the commission used the following language, which, he said, is absolutely applicable to the overcapitalization of the Consolidated Gas, Electric Light & Power Company: "The evil arising from the overcapitalization of public utilities is one of the greatest to be contended with in their proper regulation. Not only is the creation of 'water' in securities against the spirit and letter of the laws of the State, but in the case of public-service companies it is bound ultimately to perpetrate wrong either against the purchasers of the securities or against the consuming public. It appears to be a sound principle of regulation that the public, in return for special privileges granted, should be required to pay to the public-service companies reasonable return only upon the capital actually devoted to the public service, and the right to earn on inflated capital should be denied. The extravagance and wastefulness of overcapitalization can be seen immediately by taking the example of a company which has issued security obligations in excess of its real assets and then is obliged to obtain more capital for extensions, betterments or replacements. By its former issues the credit of the company is impaired, and the new issues, if sold at all, must be marketed at an extravagant discount. It cannot reasonably be claimed in such a situation that the consequences of the evils created by speculation in 'franchise values' and the hopes of exploiting the public should be assumed by the public." This unequivocal stand taken by the St. Louis Public Service Commission presents squarely to the Maryland Commission, Mr. Ritchie said, the question of whether regard for the character of capitalization which was created at one stroke in 1905-06 can result in imposing excessive rates.

OHIO COMMISSION.

After an investigation, based upon many informal complaints, the commission has ordered the Putnam Telephone Company of Ottawa to make extensive improvements by March 1, 1913, in order to furnish its patrons proper service. The commission really acted upon its own initiative

in this case, since no formal bill of complaint had been filed with it.

WISCONSIN COMMISSION.

The Southern Wisconsin Railway Company has been ordered by the commission to re-route its cars in the city of Madison in such a manner as to effect a five-minute headway over the principal portion of its system. This will necessitate the operation of additional cars, but will not, from the commission's investigation, reduce the rate of return below a value that is considered fair and reasonable.

CALIFORNIA COMMISSION.

The Railroad Commission has arranged for a general reduction in electric-lighting rates in southern California, covering a large portion of Los Angeles County, San Bernardino County, Riverside County and Orange County. This reduction will become effective on Jan. 1, 1913.

Current News and Notes

LOUISIANA SONS OF JOVE PLAN ELECTRIC PARADE.—On Feb. 1, 1913, the Louisiana Sons of Jove intend to have an elaborate electric parade in New Orleans to be followed by a rejuvenation. The day chosen will fall just in the middle of the Mardi Gras carnival season, the first parade of which will be held on Jan. 30 and the last on Feb. 4. Mr. F. B. Stern, P. O. Box 201, New Orleans, La., is the statesman for Louisiana.

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MOVING PICTURES ILLUSTRATING MANUFACTURING PROCESSES.—In order to give the engineering profession in general a clearer idea of the manufacturing processes of its various products, the Siemens-Halske Company, of Berlin, has lately furnished lecturers with moving-picture films showing the procedure in the making of incandescent lamps and various apparatus and machinery. Such lectures have been given in Germany, Sweden and Switzerland and have been received with much interest.

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WORKMEN'S COMPENSATION.—Continuing the movement begun at the convention of the National Association, the State Council of the National Civic Federation will meet in New York City on Friday, Dec. 20, for the purpose of determining if it is possible to agree upon the essentials of a bill that will be satisfactory to all parties interested in workmen's compensation legislation for New York State. The conference may continue for several days, so that there may be adequate discussion of every question.

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COMMISSION PROPOSED FOR INDIANA.—The institution of a public service commission in the State of Indiana is the purpose of a bill drafted by Senator B. B. Shively, of Marion, Ind., which will be introduced at the coming session of the Legislature. The commission will be empowered along lines similar to those of public service bodies in other states, having the right to enfranchise and adjust all matters concerning electric light, heat and power companies, express companies, telephone companies, traction companies, etc.

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N. E. L. A. RESUSCITATION CHART.—The National Electric Light Association has printed and distributed 40,000 copies of its resuscitation chart and booklet. The chart has also been printed by the United States Bureau of Mines, the United States Navy, the Chilean Navy, the Bureau of Mines of Colorado, the Industrial Commission of Wisconsin and various industrial associations and large manufacturers. Requests have been received for copies printed in German, French, Spanish and Italian, in which languages the chart will doubtless soon be published, either by certain of the manufacturers or by the National Electric Light Association.

CIVIL SERVICE EXAMINATION FOR LABORATORY ASSISTANT IN PHYSICS.—The United States Civil Service Commission announces an open competitive examination for laboratory assistant in physics (male) on Jan. 8, 1913. Eligibles resulting from this examination will be used to fill vacancies as they occur in the Bureau of Standards, Department of Commerce and Labor, at salaries ranging from $900 to $1,200 per annum. Persons desiring to take this examination should apply at once to the United States Civil Service Commission, Washington, D. C., for Form 1312. The list of cities in which the examinations will be held is included in Circular No. 7, issued on Nov. 27, 1912, by the Civil Service Commission.

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AWARD OF JOHN FRITZ MEDAL.—At a joint meeting of the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers on Dec. 5 in the auditorium of the Engineering Societies Building, in New York City, the John Fritz medal for 1912 was awarded to Mr. Robert Woolston Hunt. This medal was presented by the board of award, which is composed of representatives of the three above-named societies and of the American Society of Civil Engineers, to Mr. Hunt for his contributions to the early development of the Bessemer process. The meeting was called to order by President Alexander C. Humphreys of Stevens Institute, and he introduced Dr. John A. Brashear, who gave a short talk on rolling mills in the early days of the industry. The John Fritz medal was presented by Mr. E. Gyppon Spilsbury, after which Mr. R. W. Hunt traced the history of the Bessemer process and paid tributes to the other pioneers who had been in the work with him and had assisted him in his plans. Following Mr. Hunt's talk the meeting adjourned to the reception room in the Engineering Societies Building for a social evening.

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ELECTRICITY AS FOOD.—Happy the electrician without the wherewithal for a meal and the lean, lanky lineman with drawn features betraying lack of nourishment, for it has been discovered that a high-frequency current of 3 amp at 1000 volts is as good as a porterhouse steak and that a few doses of the "juice" will add materially to one's weight! In a communication to the French Academy of Science Professor Bergonie, of Bordeaux, says that diathermy, the method of applying a high-frequency current of low voltage, may properly supplant food by furnishing the body with a great quantity of heat. According to the professor a current of from 2 amp to 3 amp at a tension of from 1000 volts to 2500 volts furnishes more than one-third of the heat supplied by one's daily food. Nor is there any danger of dyspepsia from this electric food, for the professor is careful to state that it does not provoke the least pain. However, 60 cycles is not a high frequency, neither is 133 cycles, so that it would not be advisable for a lineman on a transmission line to partake of this phantom meal unless some one versed in the Schaefer method of resuscitation from electric shock is near at hand. Besides, since the food does not require mastication and gives no pain, it may lead to gluttony.

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SOCIETY MEETINGS.

OHIO ELECTRIC ASSOCIATION.—At the recent meeting of the meter committee of the Ohio Electric Light Association held in Columbus plans were made for holding meter conferences at Lima, Canton and Columbus in the near future. It is the purpose of the committee to make these conferences of special interest and value to the smaller of the central stations, which have not as yet undertaken regular, systematic meter testing. Invitations will be extended to all public service companies to send one or more representatives. There will be a few brief papers, a question box, and general discussion open to all. The first meeting is planned for the middle of January, to be held at Lima, Ohio.

New York Jovian Rejuvenation.—A get-together meeting and rejuvenation of the Jovian Order will be held at Healy's Restaurant, New York, on Dec. 16. This meeting is considered of much importance by reason of the fact that the next annual convention of the order, which now has a membership of 8000 men in electrical work, will be held in New York, the home city of Jupiter Frank E. Watts.

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Visiting Meeting New York Electrical Society.—On Dec. 19 the New York Electrical Society will hold a visiting meeting at the new Grand Central Terminal. On this occasion the members will be afforded an opportunity to see the new passenger station of the New York Central, which will be completed and opened to the public about the middle of January. Engineers of the railroad will act as escorts to the visiting members.

* * *

Forthcoming Byllesby Convention.—The fourth annual convention of H. M. Byllesby & Company and affiliated companies will be held in Chicago on Jan. 23 and 24. Attendance will be limited to local managers of out-of-town companies and to department heads at the home office. Business sessions will be behind closed doors and the convention will terminate with a dinner given by H. M. Byllesby & Company to the representatives in attendance.

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New York Meeting of the Harvard Engineers.—The Harvard Engineering Society of New York held its regular annual dinner at the Harvard Club, New York City, on Dec. 7. More than one hundred members and guests attended. The dinner was presided over by President A. C. Jackson. Profs. I. N. Hollis, A. E. Kennelly, H. L. Smyth and G. C. Whipple attended from Harvard University. Speeches were made in reference to the recent progress of the Graduate Schools of Applied Science at Harvard.

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Meeting of the Engineer Draftsmen.—The regular monthly meeting of the American Society of Engineer Draftsmen will be held on Dec. 19, at 8:15 p.m., in the Engineering Societies Building, New York. Prof. Walter A. Rautenstrauch, of Columbia University, will present a paper on "Rational Design of Machines," and Prof. Frederick R. Hutton, also of Columbia University, will lecture on "The Relations of the Engineer and the Draftsman." Mr. Walter M. Smyth, 74 Cortlandt Street, New York, is secretary of the association.

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Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Dec. 5 Mr. W. S. Kilmer, of New York, illuminating engineer of the H. W. Johns-Manville Company, gave an illustrated talk on modern methods of hospital lighting. Fixtures used over operating tables, indirect and semi-indirect lighting and the methods of lighting objects for microscopic examination were described. Mr. Sam A. Hobson, president of the St. Louis League of Electrical Interests, who has removed to Chicago as Western manager of the *Electrical World*, was introduced and made a few remarks. Mr. Hobson told how the "get-together" spirit had been cultivated in St. Louis, and he praised the work of the entertainment committee of the St. Louis organization.

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Institute of Radio Engineers.—The final meeting of the Institute of Radio Engineers for the year 1912 was held at Columbia University, New York on Dec. 4. Mr. E. J. Simon read a communication from Dr. G. Seibt describing in detail the latter's new direct-reading wavemeter and added some interesting data from his own experiences with the instrument. One of the meters was shown. The committee on standardization reported further progress, stating that some of its conclusions would be presented before the Institute at an early date. Jan. 8, 1913, was chosen for the next meeting, at which the results of election of officers for the new year will be announced and the annual reports read.

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Los Angeles A. I. E. E. Section.—One of the most interesting meetings of the Los Angeles Section of the American Institute of Electrical Engineers was held on Nov. 26 at Blanchard Hall. Mr. F. W. Harris read a paper on "Oil Switches and Circuit Breakers." He described the changes taking place in the voltage and current when a circuit-breaker operates as shown by the oscillograph. Several diagrams were shown to illustrate difficult points. The speaker told of the results of many tests on different types of breakers which indicate that the direction of break (vertical or horizontal) affects but little the efficacy of the breaker. Mr. Harris described the apparatus used on the New York, New Haven & Hartford Railroad electrification to overcome the difficulties encountered in the use of circuit-breakers on lines having practically no impedance and which are supplied with energy from low-reactance turbo-generators.

* * *

Formation of Utah Electric Club.—At a luncheon in the gold room of the Commercial Club of Salt Lake City, Dec. 5, the Utah Electric Club was organized with 140 charter members. Persons interested in all branches of the electrical industry are eligible for membership. The following officers were elected for the ensuing year: President, C. B. Hawley, manager Intermountain Electric Company, Salt Lake City; vice-president, H. R. Bucks, chief electrician Oregon Short Line Railroad; secretary-treasurer, W. W. Torrence, local manager General Electric Company, Salt Lake City; directors, John Jones, Westinghouse Electric & Manufacturing Company; H. M. Fennemore, Mountain States Telephone & Telegraph Company; Leo Brendenberger, Telluride Power Company; B. W. Mendenhall, Utah Light & Railway Company; E. H. Eardley, E. H. Eardley & Brother, and R. S. Folland, Capital Electric Company. Luncheon meetings will be held every Thursday at 12:15 p. m. in the Commercial Club Building. Mr. H. T. Plumb, engineer for the General Electric Company, was elected chairman for December; Mr. H. F. Holland, of the Simplex Electric Heating Company, chairman for January, and Mr. Bruce Cramer chairman for February. These gentlemen constitute a program committee in charge of meetings.

* * *

Annual Meeting of Agricultural Engineers.—The American Society of Agricultural Engineers will hold its annual meeting Dec. 26 to 28 at the Great Northern Hotel, Chicago. In the afternoon of Dec. 26 President H. W. Riley, of Ithaca, N. Y., will deliver the presidential address, which will be followed by papers on agricultural subjects and one by Mr. Eugene Becker on "Isolated Gas Lighting Plants." On Dec. 27 Mr. L. W. Chase will speak on "The Testing of Gas Tractors" and Mr. C. F. Hirshfeld will present a paper on "The Principles of Fuel Oil Engines." In the afternoon of the same day the following papers will be presented: "The Standardization Work of the Society of Automobile Engineers," by Mr. Edwin H. Ehrman; "Standards in Agricultural Engineering," by Mr. J. B. Davidson; "Standards in Agricultural Machinery," by Mr. J. A. King, and "Standards in Gas Tractor Construction," by Mr. W. J. Brandon, following which the final discussion on rules for testing gas tractors will take place. A banquet will be held in the evening. On Dec. 29 Mr. Daniel Scoates will present a paper on "Laboratory Exercises in Farm Machinery"; Mr. H. S. Ramsower will speak on "The Design of an Agricultural Engineering Building" and Mr. L. J. Hart on "The Relation Between Shop Work and General Lectures in Agricultural Engineering." Mr. I. W. Dickerson, Urbana, Ill., is secretary of the organization.

NEW NORWEGIAN HYDROELECTRIC PROJECT.

Development of the Water-Power of the Samnanger Watershed for the City of Bergen.

Watershed with an Average Precipitation of 150 In. Partly Developed for Operating 35,000-hp Hydroelectric Station—Possibilities for Impounding an Additional 3,000,000,000 Gal. of Water by Regulation—Hydroelectric and Transmission Features of Present Installation.

BERGEN, one of the most picturesque towns in Norway, lies on a hilly peninsula between narrow fjords on the western shore of Norway and is surrounded by seven mountain peaks varying in height from 1000 ft. to over 2000 ft. The city was founded about 1075 by Olaf Kyrre and has always occupied a very important part in the commercial history of Scandinavia. In 1445 the Hanseatic League established offices there and for at least four centuries following it was the commercial center of Norway. Not until the nineteenth century was its population exceeded by that of Christiania, the latter city since that time having taken the lead as a manufacturing and commercial center. Bergen still has the largest mercantile fleet in Norway, with about 300 steamers, a most remarkable number for a town of 70,000 inhabitants. Among engineering trades shipbuilding is most conspicuous, there being three large wharfs within Bergen's borders.

Though situated in a locality where large amounts of water-power are constantly going to waste, it was not until February of this year that the lakes fed from the Samnanger watershed were harnessed and the electrical energy transmitted to Bergen. In 1899 the city purchased the water-power rights and made plans for hydroelectric developments on Lake Kvittingen, but these plans were abandoned, and a steam generating station was built instead in 1900. Since then investigations have constantly been carried on for obtaining reliable data on precipitation, run-off and other factors in determining the available water power supply. In June, 1909, the municipality of Bergen decided upon a project for utilizing the water of Lakes Kvittingen, Kleivevand, Grondalsvand and Fiskevand, which empty into Lake Frolandsvand, 22 miles from Bergen, at which place the present power plant is located. The hydraulic feature of the initial development now finished is the regulation of the water of Lake Kvittingen, by means of a tunnel through which the water supply to the lower reservoirs can be regulated, and the building of a tunnel from Lake Fiskevand to the station site. This work was commenced in July, 1909, and the station began operations in February this year.

The main reservoir at Kvittingen collects the water from

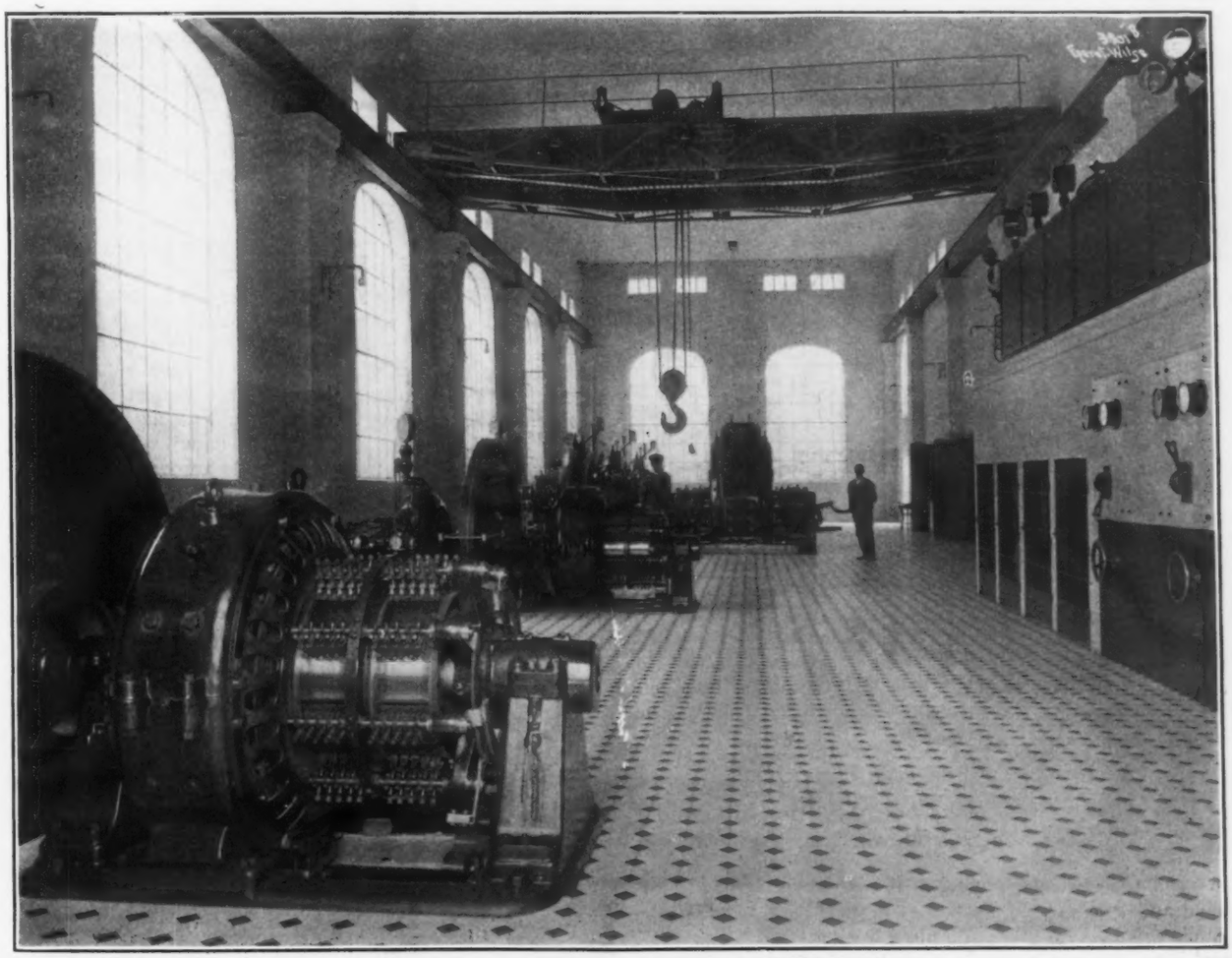
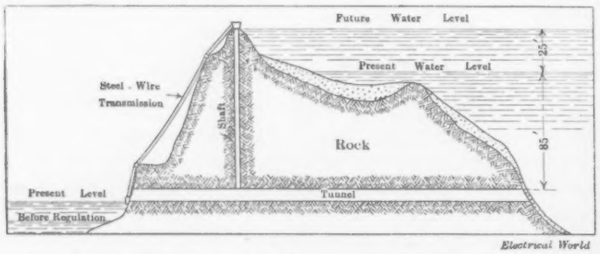


Fig. 1—Interior of Generating Room at Frolandsvand.

four rivers, the Klungerdalselven, Dukeelven, Sotabotnvasdraget and Kvarndalselven. From Kvittingen to Kleivevand there is a fall of about 100 ft.; from Kleivevand to Grondalsvand there is a drop of nearly 500 ft., and from the



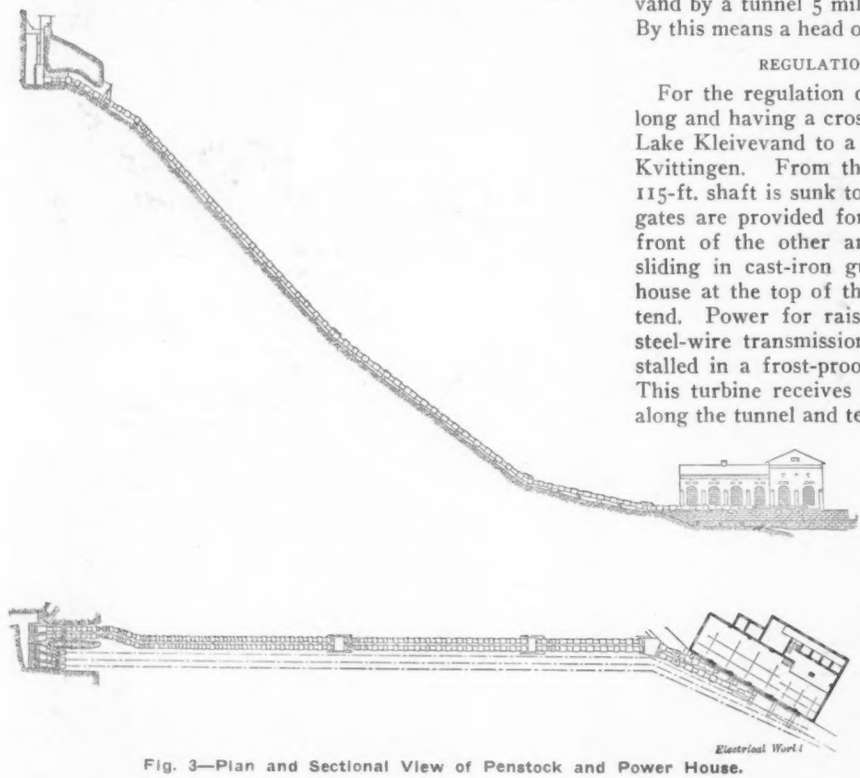
Electrical World

Fig. 2—Cross-Section of Embankment at Lake Kvittingen.

latter point to Fiskevand a 30-ft. fall obtains. The last fall is encountered between Fiskevand and Frolandsvand, where a head of about 525 ft. is available. The total drainage area of Lake Fiskevand is about 50 sq. miles.

The daily records of precipitation at the lower lake from 1903 to 1908 shows an annual average of 100 in., while at Lake Kvittingen the average is about 150 in. The average run-off of Lake Kvittingen during the same period has been 120 in. Allowing 20 per cent for evaporation this would indicate an annual average for the whole drainage area of 150 in. The maximum precipitation for one year was 170 in. The west coast of Norway is noted for excessive precipitation and may in this respect be compared with the mainland near Vancouver, B. C., where an annual precipitation of 160 in. has been observed, as noted in the *Electrical World*, Oct. 12, 1912.

The plans for the Samnanger development were based on an average precipitation of only 80 in. and a storage capacity of 700,000,000 gal. of water. This was estimated



Electrical World

Fig. 3—Plan and Sectional View of Penstock and Power House.

to yield 1580 gal. per second at the outlet of Lake Kleivevand and 1700 gal. per second at the outlet of Lake Fiskevand, corresponding to 7800 hp and 9400 hp for the upper and lower falls respectively. Taking into consideration the prospective diversity factor, it was decided to erect two power stations of 28,000 hp and 35,000 hp rating respectively, or together developing 63,000 hp, with 7000 hp in reserve at each station. The initial development referred to above involves only the lower fall and the regulation of

Fig. 4—Penstock and Power House.

Lake Kvittingen. The development of the upper fall will be commenced within a short time. However, changes in the original plans may be made, so as to place the future power station on the coast and connect it with Lake Kleivevand by a tunnel 5 miles long and a pipe line 0.6 mile long. By this means a head of nearly 1000 ft. can be obtained.

REGULATION OF LAKE KVITTINGEN

For the regulation of Lake Kvittingen a tunnel 1380 ft. long and having a cross-section of 65 sq. ft. was built from Lake Kleivevand to a point 85 ft. below the level of Lake Kvittingen. From the top of the natural embankment a 115-ft. shaft is sunk to the tunnel and two sets of cast-iron gates are provided for regulating the flow. One set is in front of the other and each set consists of three gates sliding in cast-iron guides. From the gates to the gate-house at the top of the shaft six lattice-work columns extend. Power for raising the gates is obtained through a steel-wire transmission from a 30-hp Francis turbine, installed in a frost-proof house at the mouth of the tunnel. This turbine receives its water supply through a pipe run along the tunnel and terminating inside the gates. Through a coupling mechanism in the gate-house any or all of the gates can be operated as desired.

When the construction of the tunnel had proceeded to a point about 7 ft. below the rock surface at the bottom of the lake, nineteen holes were bored and charged with 500 lb. of dynamite. For receiving the debris of the final blast two excavations in the bottom of the tunnel were made, one 17 ft. deep by 14 ft. long and the other 8 ft. deep by 17 ft. long. At the time the blast was set off the valves of the turbine were open, and when the water rushed in the turbine started to run, immediately lowering the gates.

RESERVOIR AND INTAKE.

On account of the condition at the bottom, the dam was

built about 1000 ft. below the outlet of Lake Fiskevand. It has a maximum height of 46 ft., the length at the bottom being 33 ft. and that at the crest 150 ft. The down-stream side of the dam is constructed of boulders embedded in cement and the up-stream side is composed of concrete with a facing of cement and sand in the proportion of one to two. A sluiceway, 6.5 ft. by 8.25 ft., was bored through the rock under the site of the dam. This tunnel is equipped with gates sliding in a shaft, which are operated from the top of the dam.

Fig. 5—Dam at Lake Fiskevand.

carrying the water from Lake Fiskevand to the forebay, a distance of 2.5 miles, has a cross-section of 116 sq. ft. In constructing the tunnel six shafts were sunk, each shaft being provided with electrically operated fans for ventilation. Two years and four months were required in completing this work.

Fig. 7—Lake Frolandsvand with Power House in Background.

The forebay is divided up into five chambers, one for each pipe line. Each chamber is protected by a trash rack, screen and gate, and each pipe line is in turn also provided with a gate at the inlet which is electrically controlled from the

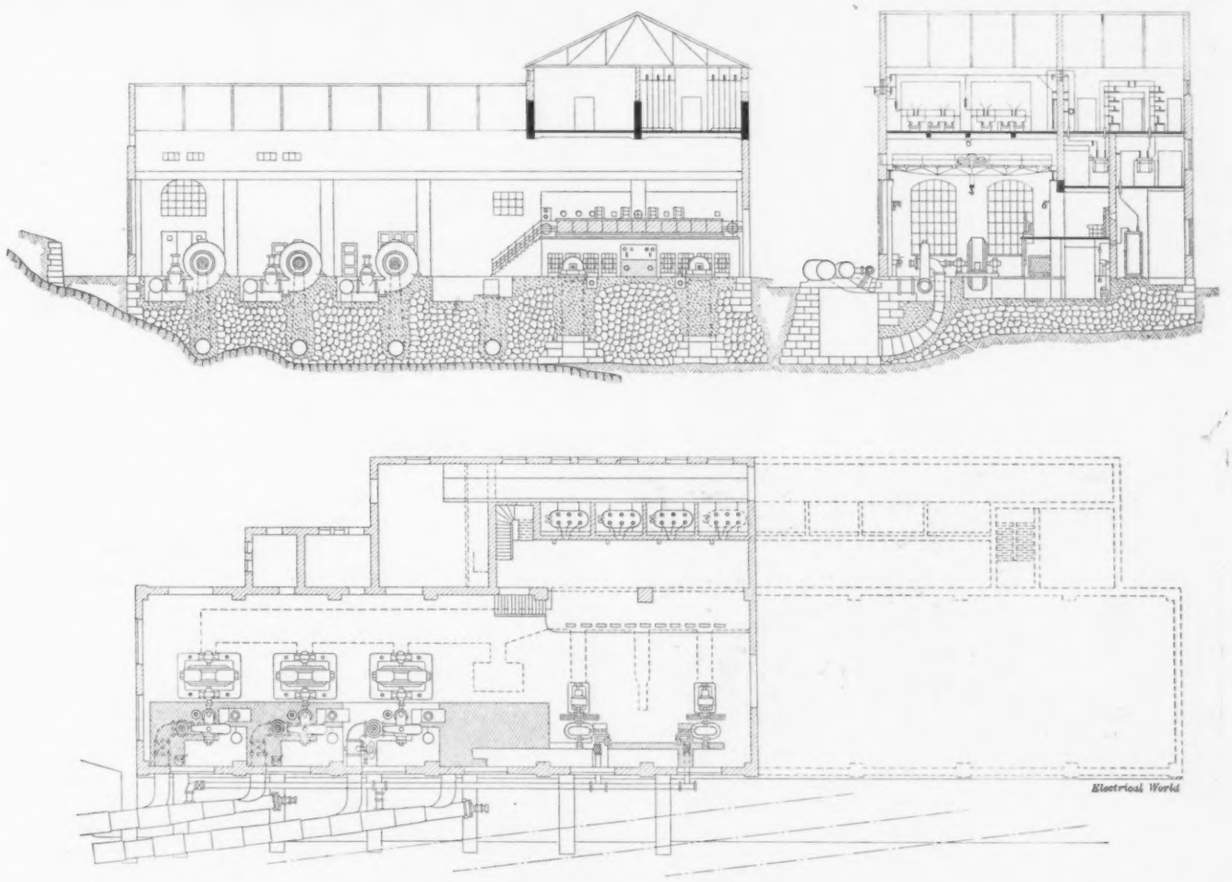


Fig. 6—Sectional Views and Plan of Power House.

The intake to the main tunnel is provided with trash rack and two gates, each 5.25 ft. by 10 ft. By means of the sluice tunnel the level of the lake can be lowered to a point below that of the intake. The gates at the intake are operated electrically from the power station. The tunnel power house and is equipped with brake cylinders filled with glycerine for the purpose of controlling the raising and lowering of the gates and preventing water hammering. A sluiceway, 14 ft. by 3.25 ft., is opened automatically when the water reaches a certain level. Floats in the forebay are

electrically connected with the power house, so that the operator is apprised when the water reaches a certain low-water level.

Provision is made for five penstocks, but at present only two are installed. Near the forebay the diameter of the pipe is 5 ft., tapering down to 4 ft. 4 in. at the bottom. The thickness of the pipe at the top is 0.28 in., increasing to 0.64 in. at the bottom. At the upper end of the pipe line a hand-operated sluice valve is installed and a similar valve is provided at the lower end. Beyond this valve in the penstock is a cast-iron plate, protecting the system from water hammer. This plate is designed to break at a pressure 50 per cent above normal. A 5-in. branch is taken off each main turbine feeder for the turbine-operated exciters.

POWER STATION.

The power house is a brick building erected upon a foundation of concrete. The floor area of the present generating plant is 136 ft. by 42.5 ft., and that of the adjoining transformer and switch house is 76 ft. by 26.5 ft. Provision is made for an addition to the generating room of nearly 100 ft. in length, the foundations for which are already in place. The total generating equipment will comprise six 3500-hp turbo-generator sets, two sets of 7000 hp each, two 300-hp exciters and one 300-hp motor-generator set. Three 3500-hp, 500-r.p.m. Francis turbines are installed and space is provided for one more in the present building. The turbines are directly coupled to the generators and are not provided with flywheels. The exciters are operated by 300-hp, 500-r.p.m. Pelton wheels. These latter wheels are made by the Kvaerner Bruk.

The generating equipment consists of three 3000-kw, three-phase generators, wound for 7250 volts and 50 cycles. These generators are cooled by means of blades attached to the rotor, which direct a current of cold air to the field poles and through ventilating channels in the stator to the stator windings. The exciters are rated at 200 kw, 115 volts, 1740 amp and 500 r.p.m. There is one 3000-kw water-cooled transformer for each generator. Ordinarily the energy is transmitted directly from each generator to its transformer, where the tension is stepped up to 47,125 volts. In case of a breakdown or other trouble the generators and transformers can be connected to auxiliary busbars and the system operated with any unit out of service. The oil switches are located on the second floor, are fitted with time relays and are operated by motors controlled from the switchboard. The bus compartments and instrument transformers are located on the third floor. From the buses the high-tension

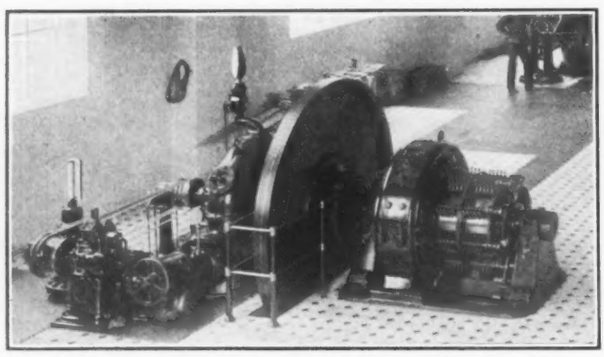


Fig. 8—Turbine-Driven Exciter.

lines are taken through oil switches, choke coils and lightning arresters to the line.

TRANSMISSION LINE.

The transmission line is designed for a tension of 50,000 volts. A double three-wire circuit of 35-sq. mm copper wire is carried on steel towers, the spacing between wires being not less than 6 ft. The intermediate towers are of the A-frame type, and at corners and other places where particular stresses occur four-legged anchor towers are used. All towers are of angle-iron construction and are set in concrete foundations. The average span is 560 ft. and the maximum 750 ft. Three-unit suspension insulators of a very large design are used. The conductor is a solid hard-drawn copper wire with a diameter of 0.23 in. and a

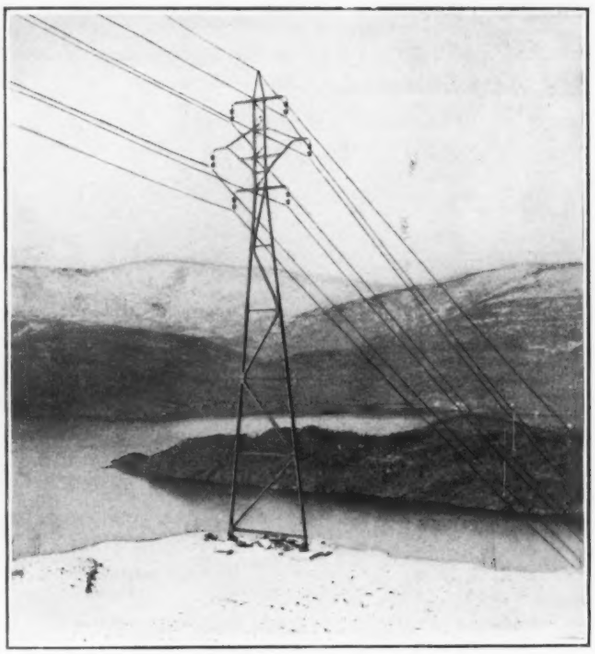


Fig. 9—One of the A-Frame Towers.

tensile strength of about 60,000 lb. per square inch. The greatest stress on the wire is calculated as 10,000 lb. per square inch at — 15 deg. F. (without snow or ice coating).

The engineering data presented in this article were contained in a paper by Mr. Ragnvald Lie, which was read at a recent meeting of the Norwegian Society of Engineers and Architects at Christiania. For the illustrations we are indebted to the *Teknisk Ukeblad*, the organ of that society.

TANDEM OPERATION OF MOTOR AND ENGINE.

At a coal mine near Peoria, Ill., the haulage system was recently electrified by installing a 100-hp motor on the engine shaft, allowing the cylinder and piston rod to remain in place. Owing to delay in getting the second of two 50-kw transformers ordered, the motor outfit using one transformer, while ample to haul a full train of cars on level track, proved to be slightly overtaxed when drawing the cars up a short grade at one section of the run. As the engine had not been dismantled and steam was still kept up in the boilers for other purposes, it was decided to try the tandem operation of engine and motor, despite the predictions of failure made on all sides.

The engine governor was accordingly set for a speed just below that of the motor so that when the latter was carrying the load without difficulty all steam was cut off from the engine cylinder. During all ordinary hauls the plant is thus electrically operated. When the grade is reached, however, the motor speed falls slightly, permitting operation of the engine governor which admits steam to the cylinder, so that the engine shares the load and the train is easily pulled over the peak of the haul. As the engine is called upon for only two minutes at a time, at intervals of twenty-five to thirty minutes, its steam consumption is negligible.

THE SILVER VOLTAMETER.

PART I.

BY E. B. ROSA AND G. W. VINAL.

THE earliest use of electrochemical decomposition as a means for the measurement of electricity appears to have been made by Gay Lussac and Thénard* about 1811, but it remained for Faraday to enunciate the conditions under which it might be used for the exact measurement of current. He declared his gas voltameter to be the "only actual measurer of voltaic electricity which we at present (1833) possess." Because of this he named it the "volta-electrometer." The earliest use of the silver voltameter of which we are aware was by Poggendorff in 1847. Since then about sixty papers dealing with this instrument have appeared, but the diversity of opinions as to the causes of the anomalous results obtained has been so great that the present authors undertook in 1909 a systematic research to discover, if possible, the best conditions under which the voltameter might be used as a primary standard for the measurement of electric current. Before describing their own work, the authors wish to give a short historical review of the subject up to 1909.

HISTORICAL REVIEW.

The years 1880 to 1886 were important because the first series of absolute determinations of the electrochemical equivalent of silver was made during that period. The first to be published was by Mascart, who measured his current by means of an absolute balance and obtained a value which when corrected was 1.1156 mg per coulomb. The work of F. and W. Kohlrausch was expressed in terms of the horizontal intensity of the earth's magnetic field. With their tangent galvanometers and several forms of voltameter, they obtained the final result, 1.1183 mg per coulomb. Lord Rayleigh and Mrs. Sedgwick investigated carefully the purity of their materials, the inclusions of mother liquor in the deposit, the effect of size and the effect of temperature and finally designed a type of voltameter that has been much used nearly down to the present time. Their values for the electrochemical equivalent were obtained with an absolute current balance. They found 1.11794 mg per coulomb to be the correct value.

Thomas Gray in 1886 made an extended investigation both of the silver and the copper voltameters, but his form of instrument (two parallel plates in a glass beaker) has not been used by later investigators. A comparatively unknown paper by Novak, published in Bohemian in 1892, was probably the first to suggest the formation of a complex ion at the anode which yielded an excess of silver deposit on reaching the cathode. The same idea was probably independently put forward by Rodger and Watson several years later and again proposed and emphasized by Richards, Collins and Heimrod in 1899. The latter made no absolute determination of the electrochemical equivalent, but on the hypothesis of the heavy anode ion, determined corrections to be applied to previous determinations, obtaining 1.1175 mg per coulomb as the mean value. They originated the porous-cup voltameter, which was very satisfactory and has been much used since.

When Kahle published the results of his extended researches on the voltameter in 1899, he noted a characteristic striated appearance of the deposit when the solution was used several times. The liberation of acid, he concluded, accompanied the formation of oxidation products at the anode. His value for the equivalent, using Clark cells as reference standards, was the same as found by the Kohlrausches. Leduc (1902) believed that the anode current density ought to be very small, so that the quantity of acid produced should be a minimum. He thought also that the presence of AgOH, if in solution, is not detrimental, and recommended neutralizing the electrolyte with Ag_2O. Mylius, in 1902, called attention to the possibility of producing a red silver precipitate by the action of filter paper on $AgNO_3$. The significance of this observation was apparently not appreciated until recently.

The first work at the Bureau of Standards on the voltameter was by Dr. Guthe in 1904, who compared several different forms and particularly noted the difference between the porous-cup and filter-paper voltameters.

Van Dijk, in 1906, compared the porous-cup and filter-paper forms of voltameter and found the difference to be 0.023 per cent, which he ascribed to the complex ion yielding an excess deposit in the latter. He gives as the electrochemical equivalent of silver 1.1180 mg per coulomb. Duschak and Hulett obtained a high degree of reproducibility and made a careful analysis of their deposits, finding inclusions amounting to about 0.011 per cent.

The important recent investigations of the national laboratories of England, France and Germany have been published by Smith, Mather and Lowry; Janet, Laporte and de la Gorce, and Jaeger and von Steinwehr respectively. Absolute balances were used to measure the current in the first two, and in the last the voltage of the cadmium cell was determined on the assumption that the electrochemical equivalent of silver is 1.118 mg per coulomb. The English and French work was based on the filter-paper voltameter.

BUREAU OF STANDARDS INVESTIGATION.

The work of the present authors, carried out in 1908-09, is described in the first of a series of four papers. In the other three, in which Dr. A. S. McDaniels is a joint author, the continuation of the work during the years 1909-12 will be described. The second paper, printed below, deals with the chemistry of the voltameter and the theory of striated deposits, the third will treat largely of the purification and testing of materials and give the second series of quantitative results, while the fourth and last paper will give the results subsequent to the International Technical Committee's work.

In this investigation ten platinum and two gold dishes have been used; four were large dishes (350 cc), four medium (175 cc), and four small ones (125 cc). All the dishes of one size were adjusted to the same weight to facilitate the weighings, which were made on three balances (one for each size of dish) mounted on piers in a special constant temperature room, so arranged that the balances could be read by telescope and scale from outside the room. For weighing the dishes, similar ones reserved for tare were used, and the silver was counterbalanced by special silver weights, gold-plated. Buoyancy corrections were thus eliminated. The types of voltameters used were: (1) the Rayleigh or filter-paper form; (2) the Richards or porous-cup form; (3) the Poggendorff form without septum, excepting a glass cup, hung under the anodes or with silk around the anode; (4) the siphon type.

The deposits were timed automatically by a chronograph and the ticks of a standard Riefler clock. The circuit was so arranged that the current could, after adjustment, be thrown on to the voltameter circuit and maintained constant to a degree usually better than 1 in 100,000 during the course of the experiment. Particular attention was paid to the insulation resistance. The reference standards were a Wolff manganin coil of 1 ohm or 2 ohms in oil and four standard cells in an oil bath maintained at a fixed temperature. The drop in potential across the standard resistance was made equal to the voltage of one of the cells and kept so by regulating the current. As a further check, a potentiometer was also included in the circuit. Our reference standards were frequently compared with the standards of the bureau, and suitable corrections were made.

The porous cups were of Pukal ware made by the Königlich Porzellan Manufaktur of Berlin. They were

*These and other references will be discussed in more detail in the full paper and the places where they may be found will be given.

prepared by filtering dilute HNO_3 through the pores, and, after eliminating the acid by distilled water, the cups were soaked in pure electrolyte. Between experiments they were kept submerged in electrolyte.

After washing the deposits and replacing any loose silver, the cathodes were dried in an electric oven at 150 deg. C. After cooling they were placed in the balance case for several hours before weighing.

The first experiments with the Rayleigh voltameter showed, as a mean of thirty-seven experiments, the value 1.01866 volts at 20 deg. C. for the Weston normal cell, assuming the electrochemical equivalent of silver as 1.11800 mg per coulomb, as defined by the London conference of 1908. A difference of about forty parts in 100,000 was found between this and the porous-cup form, the latter giving a lower value. It occurred to the authors that if this excess were due to the filter paper letting through a complex ion, as supposed by Richards, doubling or tripling the thickness of filter paper ought to decrease the discrepancy. But it was found that using two or three sheets of filter paper had just the opposite effect and also increased the striations, which were soon found to be a sure indication of a heavy deposit. It was found that the excess of deposit in the filter-paper form over that in the porous-cup form depended on the amount of filter paper present, and that the porous-cup voltameter gave the same high values as the filter-paper form if filter paper were wrapped around the outside of the porous cup or if the electrolyte had previously been contaminated by soaking filter paper in it.

When solutions were repeatedly used in a filter-paper voltameter the deposits were increasingly heavy with each electrolysis, but a similar experiment with the porous-cup voltameter always gave the same weight or slightly lighter. To test further the complex ion theory, the authors tried re-electrolyzing some of the electrolytes saved from inside the porous cups; this is the anode liquid which should give too heavy a deposit if Richards' theory is correct. It was found, however, that if the electrolyte was free from filter paper the deposit was perfectly normal.

Many of the deposits were examined under the microscope and also photographed. From pure electrolytes the deposits were always crystalline and non-striated, and, indeed, the appearance of the deposit was found to be a good criterion of the purity of the electrolyte.

It was found that to produce a heavy deposit it was not necessary to bring the electrolyte and filter paper together, but merely to make up the electrolyte with water that had stood over filter paper for a short time. It was evident that important chemical changes were produced in the electrolyte by the filter paper, and, accordingly, Dr. McDaniels joined us in the summer of 1909 to study the chemistry of the voltameter.

With the porous-cup form the authors obtained 1.01828, volts for the Weston Normal cell at 20 deg. C, and this is very close to the final result, which will be given in the last paper of the series.

PART II.

By E. B. Rosa, G. W. Vinal and H. S. McDaniel.

Deposits made from pure $AgNO_3$ and water in a porous cup voltameter or one without septum are beautifully crystalline under the microscope, as shown in Fig. 1. The crystals have sharp faces and angles, and between the crystals the platinum surface is clean and bright. From a slightly contaminatd solution the deposit is often in long needle-shaped crystals or imperfectly crystalline and striated. As the amount of impurity increases, the striations increase in prominence and the deposit looks more like slag with no easily detected crystalline structure, as in Fig. 2. For excessive amounts of impurities, the deposits are gray and look more like lead than silver. In this qualitative work the deposits were made in small voltameters and then photographed.

The action of filter paper on water was first investigated, and it was found that if the $AgNO_3$ solution was made from water that had been in contact with filter paper for even a short time the resultant deposit was strongly striated and the electrolyte turned a reddish brown, suggestive of a colloidal solution. The same was true no matter what quality of filter paper was used. Prolonged washing of the filter paper for twelve days did not eliminate the effect. Writing paper, blotting paper, etc., all produced the same result, as did also papers made exclusively from wood, linen or cotton rag, and of the latter substances, wood fiber gave the most exaggerated effects.

The addition of acid to the pure electrolyte merely increased the number of crystals by decreasing their size and did not affect the structure of the deposit. The effect of $CuSO_4$ and $Cu(NO_3)_2$ was similar. Silver acetate very greatly increased the number of crystals, making the deposit look like a field of snow. Gelatine, often used as an additional agent in electroplating, produced exaggerated effects and a yellow solution apparently of colloidal silver.

By Bredig's method a considerable quantity of colloidal silver was prepared. It was first of a neutral tint, but after about a year turned to an olive-oil color. A sample of this was placed in a U-tube between electrodes with 120 volts difference of potential, and after twenty minutes it was certain that the colloid was traveling toward the cathode,

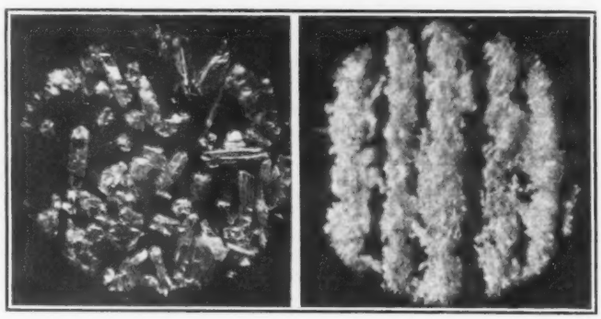


Fig. 1—Crystalline Structure. Fig. 2—Striated Formations.

and on reversing the current it moved in the opposite direction to the new cathode, finally hanging on it as a loose mass. A small amount of this material added to $AgNO_3$ and electrolyzed modified the deposit in appearance. By using a porous cup as a filter, this colloid could be removed from solution, which suggested filtering a strongly contaminated $AgNO_3$ solution. This was done, and the resulting deposit was crystalline and entirely free from striations. Because of the importance of this fact, further tests were made with similar results.

A systematic study of the chemistry of the voltameter eliminated the possibility of the observed effects being due to impurities in the filter paper or to the formation of silver hyponitrite, as suggested by Smith, and led to a question of the behavior of cellulose and silver nitrate solutions.

The present authors observed in their qualitative experiments that the striations could be produced only by adding strong reducing agents to the electrolyte. Such weak reducing agents as starch and cane sugar were without effect. This fact, together with the possibility of preparing red colloidal solutions by the action of filter paper alone on silver nitrate solution, showed that cellulose must act as a strong reducing agent. The identity of the colloid was fully established. Experiments showed that the extract of filter paper was 1000 times as active in reducing $AgNO_3$ as cane sugar, and emphasized the seriousness of filter paper as an impurity. The result of a long series

of experiments led to the conclusion that the reducing action on $AgNO_3$ solutions takes place through the formation of oxycelluloses, probably decomposing into furfuraldehyde or some of its homologues. Since pure cotton cellulose is a hexopolyose, and not generally considered as yielding furfuraldehyde, careful tests by Forster's method were made which showed it to be present. A pure electrolyte containing 0.001 per cent of polymerized furfural when electrolyzed gave a strongly striated deposit similar to that of the filter paper voltameter. It is the author's belief that oxycelluloses constitute the soluble furfural-yielding substances, and that after being extracted they are again formed by oxidation in the air, and hence the filter paper does not lose its power to produce striated deposits. The oxycellulose solution is colloidal in character and very permanent. When it is added to silver nitrate solution a red colloidal solution is obtained which is not readily coagulated owing to the protective action of the organic colloid. Some of the hydrogel obtained from these red colloidal solutions was found by analysis to be 97 per cent pure silver, the remaining 3 per cent being organic material. Further confirmatory evidence is obtained from carefully following the acidity changes of solution of $AgNO_3$ treated with the extract from filter paper.

With such good evidence of the presence of silver colloids in contaminated solutions supported by actual observations on the colloids by the ultra-microscope, it seemed probable that the excess weight and the changes in structure of the deposit were due to this colloid. The authors have formulated a theory to account for the changes from the crystalline deposits of pure solutions to the non-crystalline and striated deposits of the impure solutions. In 1876 Kirmis, working under Helmholtz, made a study of the various forms of silver deposit, but failed to offer any explanation of the cause of striations. Nearly twenty years later Behn, working under Kundt, published an elaborate study of striated deposits. He carried out many ingenious experiments and proved conclusively that the direction of the striæ is the direction of the convection currents, as we have also done, but his explanation of filaments in the liquid as the cause of striations is not satisfactory, as he himself acknowledges. The explanation offered by Smith, Mather and Lowry is somewhat similar to Behn's. The strongest argument against their theories is that the striations disappear completely when the electrolyte is pure, all other conditions remaining the same.

Since the reducing impurities mentioned which produce striations also produce colloidal silver when added to the electrolyte, it appears that the first essential condition for striations is the presence of a colloid that will be deposited on the cathode. The second essential condition is a motion of the liquid over the cathode surface. On the under side of a horizontal cathode, where convection currents along the surface are eliminated, the deposit is characteristic of an impure solution (if that is used) except that there are no striations. This and numerous other experiments establish the second condition. It is, of course, well known that the deposit from a cyanide solution of silver and potassium appears continuous under a very high power microscope, while a discontinuous deposit is obtained from a nitrate salt. As Ohm's law holds in the electrolyte, it is evident that there is at the surface of the platinum a potential difference opposing the current which brings the electrolyte in contact with the platinum to a higher potential than that of the electrolyte in contact with the silver, and so the currents diverted from the platinum surface find numerous outlets to the platinum through the silver crystals. The surface potential difference taken in connection with the specific resistance of the electrolyte and the current density determines the distance apart of the crystals and the striations also, as will be shown.

Based on these experiments, the following explanation of striations is given by the authors. The regular crystalline growth of the silver takes place according to the cubic system. Each ion, deposited as an atom, is constrained to occupy such a place that the crystal grows into a definite shape. But this growth may be broken up by the relatively large colloidal particles which are deposited and, if present, these form new nuclei for crystalline growth. The more colloid there is present, the more the regular crystalline structure will be interfered with. When the current is applied the deposit begins at many isolated points without definite arrangement, and these will grow into regular crystals if allowed to take their own course, but if the colloid destroys the crystalline structure, these masses of silver will grow in the direction of the convection currents of liquid, and eventually one crystal will grow into the one above it (if the currents are vertical as in the ordinary voltameter) and that in turn into the one above it, until the deposit is in the form of the familiar striæ.

In the case of pure electrolyte the "crystallizing force" overcomes this upward tendency of the convection currents, but it is possible to force striations in a pure electrolyte by making the velocity of the liquid over the surface great enough to overcome the crystallizing force. This has been accomplished by rapidly rotating a piece of platinum in a horizontal plane in pure electrolyte, and so obtaining spiral striæ. This explanation is believed to be adequate and in accord with all the known facts.

The third paper of this series will give in detail the processes for obtaining silver nitrate of sufficient purity for use in the silver voltameter and report the second series of quantitative measurements. The methods previously used for purifying the salt have proved to be unsatisfactory for work of the highest precision with the voltameter.

MOTOR-DRIVEN WINCHES AND PULLEY HOISTS.

By H. THIEME.

MOTOR-DRIVEN winches and pulley hoists meet a real want in industrial circles and have become very popular. The compact design of the traveling winch, which allows the ground surface to be utilized to its fullest extent, has won for itself special favor on storage grounds, building sites and in workshops where it is necessary to carry objects over short distances expeditiously. The traveling which can not only be operated on the lower flange of the I-beam of a rigid straight or curved track but can also be attached to a traveling crane or to the jib of a slewing crane (Figs. 1 to 3). Motor-driven winches will do good service on storage grounds when the area must be covered quickly, as in conveying material from railway trucks to remote sheds and for handling traffic in the reverse direction. It is also worthy of particular notice that the possibility of the trolley taking curves of small radius will permit objects to be transferred from one shop to another through doors and passages just as well as by means of rails and turntables, but with the additional advantage that the ground area remains absolutely free, so that safe and unimpeded traffic can be arranged. In such cases the traveling winch can be advantageously fitted with an operator's stand, whereby speeds can be reached which would be inconceivable if the winch were controlled from the ground by means of ropes. Heavy winches are frequently fitted with rotating frames for rounding sharp curves.

The traveling winches are designed for electric hoisting movement and propulsion by hand, or both movements can be effected electrically, a special motor being provided for each movement.

The pulley hoists will be found frequently in combination with traveling or slewing cranes. They can also be attached at the top of a mast or column and are therefore often used on large building sites as a convenient, quick

and reliable means of transportation for all sorts of building material.

The pulley hoist also performs excellent service, in combination with heavy electric traveling cranes, for raising loads which are much smaller than the maximum capacity of the crane itself. The pulley hoist is hung on the crane hook in its highest permissible position and, with the assistance of the smaller hoisting motor of the pulley hoist, can raise or lower the lighter loads at a far greater speed. Where this method is not adopted it is either necessary to select a hoisting motor for the traveling crane of much higher capacity than is actually required for operating the crane with heavy loads only or the main winch must be complicated with the insertion of an auxiliary winch or mechanical disengaging device which would for the most part remain unused. The separate pulley hoist can always be employed elsewhere when the crane is handling heavy loads in the usual course of its duties.

The construction of the hoisting mechanism is made very compact by the employment of a worm drive as a revolution-reducing agent. Such a drive will also make the operation as noiseless as possible, because the wheel gears which are still necessary will run at a comparatively low speed. The worm gears, which are manufactured by the Maschinenfabrik Oerlikon, are cut out of first-class steel and wormwheels are fitted with a band of phosphor bronze. The axial pressures are taken up by ball bearings immersed in oil. The entire worm gear is inclosed and runs in an oil bath. By exact workmanship, excellent lubrication to which special attention is given and a relatively small specific pressure a very high degree of efficiency is attained with the multi-threaded worms. The wear and tear is reduced to a minimum by the employment of suitably hard, tough material, such as steel and phosphor bronze. Wire ropes of plow steel with a high breaking strain and great elasticity are exclusively used as carrying agents. The winch running rollers are made of cast steel; they run on their axles, which have runner boxes of bronze and are provided with Stauffer central lubrication.

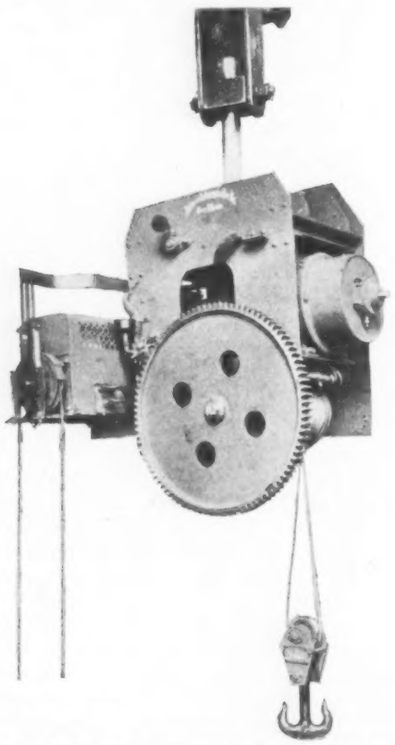


Fig. 1—Ton Pulley Hoist Showing Crane-Hook Attachment.

The driving motors are designed with special consideration for the requirements of operating with hoisting appliances and for high overloads. They are coupled with the worm gears by means of a semi-rigid coupling designed as a brake sheave and are of the entirely inclosed type, so that the interiors are protected from steam, dust and inclement weather. The bearings are furnished with ring lubrication and the shafts are of first-class steel.

The direct-current motors used for the hoisting movement

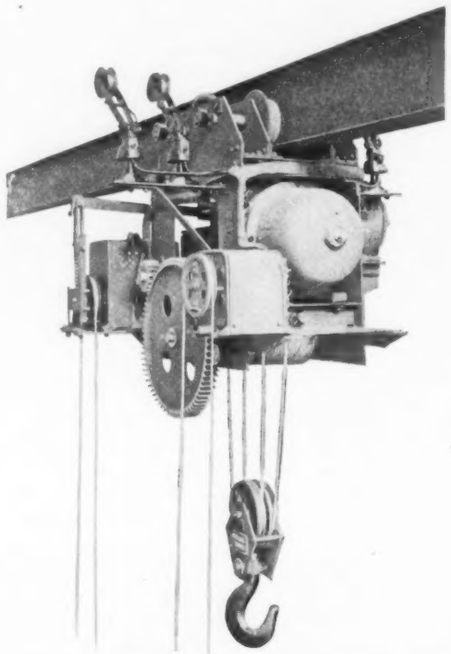


Fig. 2—Motor-Driven Winch, 2-Ton Capacity.

are compound-wound motors. The speed consequently increases automatically with a reduced load up to the maximum limit. The traveling motors are series-wound and also have the above characteristics. With three-phase currents either synchronous motors or induction motors are employed. The current supply is taken from the main lines, laid along the running track, by means of a rolling contact.

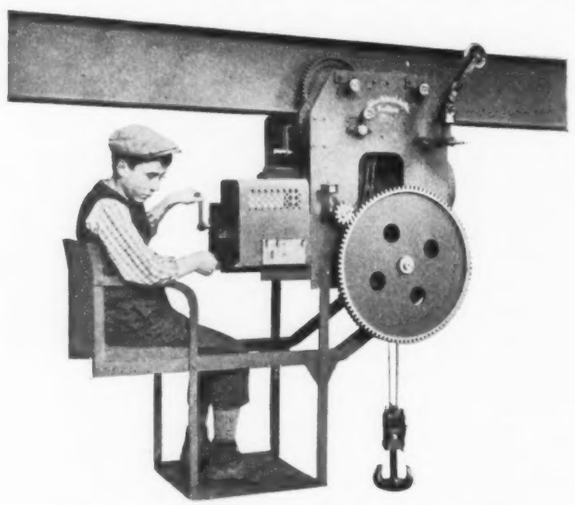


Fig. 3—Motor-Driven Hoist with Operator's Stand.

In practice the average motors are built for a maximum torsional moment equal to two and one-half times the normal moment. They can stand double the normal number of revolutions (on direct current generally two and one-half times) and frequent sudden reversals without hurt to themselves. They comply in general with the regulations of the Verband Deutscher Elektrotechniker (Association of

German Electrical Engineers) with respect to overloading, temperature rise and insulation strength.

The control of the motors is effected from the ground or from an operator's stand fitted on the winch. If an operator's stand is selected, this is so constructed that the operator has a good view of the movements of the load in every position, even though the stand is entirely inclosed with glass windows. The motor control is effected by means of the regulating controllers on the winches or by switching over in the case of short-circuit motors. The throw-over switch is also combined with this control apparatus, so that all manipulations for starting, regulating, stopping and reversing a motor can be actuated by one single control agent.

In general a brake is provided only for the hoisting movement. A strong jaw or band brake is used which acts automatically on the coupling between motor and worm gear, being combined with the hoisting starter or put in action by means of an electromagnet or auxiliary motor. The traveling mechanism of the motor-driven winch with operator's stand is provided with a foot brake, if this is considered necessary.

The traveling winches and pulley hoists are built by the Maschinenfabrik Oerlikon for loads up to 11,000 lb., whereby the speeds of the various movements can be selected to suit the working conditions within very large limits. This allows these hoisting appliances to meet all modern requirements in every respect.

ELECTRICITY VERSUS GAS FOR STREET LIGHTING.

BY T. OSBORNE.

ELECTRIC lighting for the streets of large towns has been shown to be superior to gas as the result of exhaustive tests made by experts at the request of the electricity and gas committees of the city of Manchester, England. At present several important streets are lighted by flame-arc lamps, while others are lighted by modern high-pressure gas lamps of high candle-power. It was desired for the future guidance of the municipal authorities to have expert opinion as to which system yields the better results, and two well-known lighting engineers, Messrs. H. T. Harrison and J. A. Body, were instructed to make prolonged investigations and to submit reports, which are summarized below so far as they apply to the arc lamps. Some brief reference is also made to gas lamps, so as to make the data on arc lamps perfectly clear.

For the purpose of the tests two important streets were selected in the heart of the city, one lighted by electricity and the other by gas, and four lamps on each were subjected to close examination. The arc lamps are suspended along the center of the street, at a clear height of 27 ft. 6 in. and at the following distances apart, 114 ft. 7 in., 116 ft. and 132 ft. Tests were made from three sets of positions at a height of 15 in. from the ground, (1) directly below each lamp, (2) at the center of the street half way between each lamp, (3) on the curbstones of the footpath half way between each of the lamps. These tests were for horizontal illumination. Direct-illumination, or candle-power, tests were made 4 ft. from the ground at the positions mentioned above and, in addition, at positions 6 ft. 6 in. from a perpendicular from each lamp. The gas lamps were placed closer together, the distances ranging from 98 ft. 6 in. to 118 ft. 6 in. The lamps tested are of the "Metroplane" magazine flame-arc pattern, with clear inner globes and opalescent outer globes.

The electric lamps are connected eight in series on a 400-volt circuit, obtained from the ordinary distributing network supplied by the municipal plant. Each lamp takes an average of 583 watts, and the circuits are so arranged that every alternate lamp can be switched off when desired. The cost of the electric lamps is considerably less than that of gas lamps. The cost for electrical energy, depending as it does on the load factor, varies for the half-night lamps, which burn only 2000 hours per annum, and the all-night lamps, which burn 4000 hours, being 2.14 cents per kw-hr. for the former and 1.31 cents per kw-hr. for the latter. Thus for one hour the cost for electrical energy would be: (a) Half-night lamps, 583 watts, at 2.14 cents per kw-hr., 1.248 cents; (b) all-night lamps, 583 watts, at 0.655 cent per kw-hr., 0.764 cent.

To this must be added the cost of carbon electrodes and labor. Each lamp contains fourteen pairs of carbon electrodes, which during the tests exceeded five burning hours per pair. These electrodes as used at present cost $18.24 per 1000 pairs; it follows that one hour costs 0.36 cent. It takes two men fifteen minutes to trim and clean each lamp. A trimmer and an assistant are employed, earning respectively 14 cents and 12 cents per hour. Thus the trimming and cleaning, should the lamps be cleaned once in fifty hours, would be 12 cents per hour. Together with an allowance for repairs and for maintenance, this makes the total cost per hour for the electric flame-arc lamp as shown in the table.

TOTAL COST PER HOUR FOR FLAME-ARC LAMP.

	Half-Night Lamps, Cents per Hour.	All-Night Lamps, Cents per Hour.
Electrical energy	1.250	0.764
Electrodes	0.360	0.360
Labor	0.120	0.120
Sundries	0.070	0.156
Total	1.800	1.400

As lighting and extinguishing are automatically carried out by time switches, no charge has been allotted for this service. The relative capital cost of the plant and apparatus is as follows: The four arc lamps tested are a portion of sixteen along the same street, which, including all accessories, are stated to have cost erected $2,707, equal to $170 per lamp.

The high-pressure gas lamps compare very unfavorably, as the total cost of the lamps, lanterns, poles, suspension and all accessories erected amounted to $933, equal to $233 per lamp. These figures do not include any amount for series street-lighting mains in the case of the arc lamps, or any for high-pressure gas mains or compressor plant. This obvious flaw is due to the peculiar system of accounts kept by the public authorities. The experts who tested the lamps commented on the absence of these items. The capital cost per mile of street would be as follows: For the arc lamps, 43.6 to the mile, $7,532.08; for the high-pressure gas lamps, 49.34 to the mile, $11,841.60. The relative constancy and reliability of the light sources were the next points to be considered. During the two months in which the four electric and four gas lamps were under inspection the maximum variations, exclusive of extinctions, were as follows: (a) Any one of the electric lamps, from 4400 cp to 2420 cp; all the arc lamps, from 4400 cp to 2400 cp; (b) any one of the gas lamps, from 2058 cp to 686 cp; all the gas lamps, from 2475 cp to 686 cp. It is essential to point out that these variations frequently continued over only a short period and that they are not often noticeable, thus showing that the variation in illuminating power of the gas lamps is more than that of the electric lamps. The total number of complete extinctions noted by the experts during the two months' period was as follows: Arc lamps, June 14, one lamp out for eighty minutes; July 19, one lamp out for twenty minutes. Gas lamps, June 16, one lamp out for twenty minutes; June 18, one lamp out for sixty minutes;

June 23, one lamp out all night; July 21, one lamp out all night. The electric lamps thus worked in a more reliable manner. In comparing these results and failures it is essential to add that half the arc lamps burn all through the night; that is, twice the number of hours of the gas lamps. It follows, therefore, that the electric lamps are considerably more than twice as serviceable for street lighting, from this point of view, as the gas lamps. The difference in the degree of illumination throughout the streets, irrespective of the variations in the candle-power of the light source, was 4.5 per cent for the arc lamps and 4.8 per cent for the gas lamps. It will be noted, therefore, that there is little to choose between the gas lamps and the electric arc lamps in this respect.

It may be interesting to work out the reduction of costs to a common basis of candle-power and illumination. The comparison on an equal basis of cost may be made as follows: From the details given it will be noted that for a cost of 1.4 cents per hour the arc lamps give an illuminating value averaging 2970 cp—that is, at the important angles, namely, 20 deg. to 25 deg. from the horizontal; while the gas lamps give under similar conditions only 1750 cp, at the cost of 3 cents per hour. Thus the candle-power at a cost of 3 cents would work out as follows: Electricity at a cost of 3 cents per hour gives 6364 cp; gas at a cost of 3 cents per hour gives 1750 cp, or electric lamps giving 2970 cp cost 1.4 cent per hour and gas lamps giving 2970 cp cost 5.08 cents per hour.

From a comparison on an equal basis of illumination the arc lamps also have an advantage. Dealt with from this point of view the distances at which the lamps are spaced comes into the calculation, and as this varies owing to local conditions it will be desirable to take a unit length of street, say 1 mile, and to ascertain the number of lamps of either type which would be necessary to give the same illumination. As the arc lamps when spaced at an average distance of 121 ft., or 43.6 to the mile, produce a minimum illumination of 0.5 foot-candle when giving an average of 2970 cp at a cost of $1,220 per annum while burning for 2000 hours, it will be found by a simple calculation that fifty-four gas lamps giving an average of 1750 cp will be required to produce the same result, placing them in an inferior position as compared with the electric lamps. Further, as the gas lamps cost 3 cents per hour—equal to $60 per lamp per annum—when burning 2000 hours, the comparison works out as follows: Cost per mile minimum illumination, 0.5 foot-candle: for four arc lamps, $1,220; for four gas lamps, $3,240.

COMPARATIVE COST OF ARC LAMPS AND GAS LAMPS.

	Arc Lamps.	Gas Lamps.
Candle-power of lamps	2970	1750
Number of lamps to the mile	43.6	49.34
Running costs per lamp per hour up to 11:30 p. m.	1.4 cent	3 cents
Capital cost per mile of street	$7,531	$12,177
Running cost 1000 cp-hours	0.472 cent	1.714 cent
Cost per annum per mile equal illumination	$1,220	$3,240
Minimum illumination basis of comparison	0.5 ft.-candle	0.39 ft.-candle
Cost per mile of street per annum up to 11:30 p.m. at above illumination	$1,220	$2,960

In the figures given above the cost of energy in the electric lamps is taken at the all-night rate. When they are taken at the half-night rate the cost would amount to $1,508. A general comparison of the two systems of lighting after 11:30 p. m. is interesting. The figures given above apply only up to the time when the gas lamps are turned out and every alternate arc lamp is shut off. When the gas lamps are put out the ordinary gas lamps of the old system, which is being gradually superseded, are relied upon. After 11:30 p. m. the comparisons of cost for equal illumination are still more diverse, as in the case of the gas-lighted street in which the tests were made the low-pressure gas lamps, of which there would be eighty to the mile, and the cost of which cannot be taken at less than $9.60 per lamp per annum, give a minimum illumination of only 0.004 foot-candle for a cost of $768 per annum; whereas the alternate arc lamps give a minimum of 0.08 foot-candle, twenty times as much, at about the same cost. To enable readers to appreciate the details given above they are given in a tabulated form.

There can be no doubt even from a hasty examination of these figures that electric lighting can be carried out by the electrical department at a considerably lower cost than is possible by the use of gas, and it must also be noted that as electrical undertakings are of relatively modern growth many economies in cost of production will no doubt be effected in the early future. It may be added that had the gas lamps been working at double the efficiency, or if the cost of electrical energy had been double what it is, the electric arc lamps would still have proved to be more economical for an equal illumination.

In the case of high-pressure gas lamps better efficiency has been obtained in other towns in England. This has been obtained, however, by the use of a higher pressure, which necessitates that more time and money be spent on careful periodic adjustments.

For the tests detailed above three photometers were used, one being a portable instrument for rough measurements fitted with a Bunsen screen; the other two were universal photometers. The accuracy of this instrument is high, as the flicker attachment is used for direct measurement, thus reducing to a minimum any error due to variation in color of the light sources, and for horizontal measurements the arrangement adopted by the Board of Trade was used. Tests were constantly and independently made by the expert and his assistant over a period of two months, and as the results were practically identical, it follows that the accuracy of the light measurements may be taken as within 5 per cent.

The artificial illumination of streets by electric lamps fixed at intervals results in a varying degree of illumination, depending on the distance from the source of light, and as that illumination is inversely proportionate to the square of the distance and depends on the angle at which the light falls on the surface, it will readily be seen that much depends not only on the candle-power of the electric lamp but also on the way the lamps are spaced and the height at which they are erected. With the object of taking in all the factors—that is, candle-power, distance and height—it is becoming the practice in England to compare the illumination of streets by ascertaining the minimum horizontal illumination of a screen 3 ft. above the ground level at any part of a street. This minimum factor is considered the important one not only because it embodies all the others, but because if the minimum illumination is sufficient for the pedestrian and road traffic the illumination throughout the remainder of the street will be ample. The tests the results of which are discussed above included photometric measurements of candle-power and illumination, which were carried out every night when the weather permitted; periodic measurements of the electricity consumed to check the meters installed, and also daily and nightly inspection of the lamps to check consumption, renewal of mantles, carbons, cleaning and repairs. During the tests the lamps were operated as in ordinary practice; that is, adjustments and alternations were permitted only when found absolutely necessary. In the case of the flame-arc lamps the reflector, ash tray and support were modified in the case of one lamp to demonstrate that the shadow cast under the lamps can be eliminated.

Central Station
Management, Policies and Commercial Methods

SEPARATION OF PROMPT-PAYMENT AND QUANTITY DISCOUNTS.

Upon the advice of the Ohio Public Utility Commission, the Canton Electric Company, of Canton, Ohio, has issued a supplement to its lighting schedule, separating discounts granted for long-hour and quantity use from those allowed for prompt payments made within ten days. When the utility law was first passed, the company's rules provided that all discounts, whether for quantity or hours' use, should be allowed only if paid in ten days of date of bill. Before the adoption of the act there was some elasticity in applying this rule, particularly where the bills were large and the discount also large. After the passage of the act the company gave all hands notice and then rigidly enforced the discount provisions.

A customer, however, had a gross bill of $9.80 which would have been discounted at 50 per cent had he paid within the discount period. He appealed to the commission, and it notified the company to separate its discounts into prompt-payment discounts and such discounts as should be allowed for long-hour burning. This was done, as the following supplement to the Canton company's lighting schedule sets forth:

"*Rate.*—10 cents per kw-hr.

"*Discounts for Quantity and Hours' Use.*—Over $2 and over two hours' daily average use, 10 per cent; over $3 and over three hours' daily average use, 20 per cent; over $4 and over four hours' daily average use, 30 per cent; over $5 and over five hours' daily average use, 40 per cent.

"*Prompt Payment Discount.*—In addition to the discounts above set forth, an additional discount of 10 per cent will be allowed on all bills which, minus the discount, amount to more than $1, provided payment is made within ten days from date of bill."

PHOTOMETRY FOR THE CENTRAL STATION.

At the November meeting of the New England Section of the Illuminating Engineering Society Mr. S. R. Keyes, of the Boston Edison company, presented a paper on "Central Station Photometric Practice," illustrating by apparatus and lantern slides the methods of operation of the principal types of photometers now in service. The author emphasized the physiological sensations which render the direct estimation of light values difficult, stating that nearly every solicitor connected with a lighting company has come in contact with a customer who attempts to "size up" the qualities of an illuminant in this manner and then complains of the lack of sufficient light because he is unable to see anything when he turns away his eyes from the light source. The balancing of lighting effects, on the other hand, is more accurately perceived by the eye and is used in practical photometric work with great success.

After describing the methods of using the photometer common to central-station practice the speaker emphasized the desirability of testing the candle-power of returned lamps, as in many cases these are found to be so good as to warrant their being sent out again under the system of free renewals widely in vogue. Such work is usually performed on the Bunsen form of photometer, as speed rather than extreme accuracy is the desired end, and this form of screen, where the observer uses both eyes, is less tiresome when employed over an extended period than is the Lummer-Brodhun type of photometer.

In the case of the Boston Edison company, the lamp division photometers returned lamps in the above manner, and the laboratory department obtains samples of these lamps, which are in turn tested on the standard photometer as a check on the work of the lamp division. Two per cent of the lamps tested by the latter are re-photometered by the former. In checking these lamps on the laboratory photometer only one setting is made of each lamp against ten or twenty in ordinary work, as it has been found that with lights of the same color the Lummer-Brodhun screen is so sensitive that the requisite accuracy may be obtained in this way.

When a Lummer-Brodhun sight box is available measurements of the coefficient of diffuse reflection of samples of cloth, wall paper, paint, etc., may be very simply and easily made. To do this it is first necessary to obtain a suitable test plate whose reflection coefficient is carefully determined. A small piece of Strathmore drawing board such as is used by artists answers the purpose, such a test piece having a coefficient of about 0.75. The plaster disk is removed from the Lummer-Brodhun sight box and the test plate is cut into two strips of such dimensions that they will fit into the slot in the sight box left vacant by the removal of the screen. Two lamps of approximately equal candle-power are then procured and installed at each end of the bar. The two test strips are inserted in the sight box back to back and the carriage is set at the zero point in the center of the scale. A balance is then obtained by varying the voltage on either lamp and the photometer is then set ready for use. One of the test plates is then removed and the sample to be tested is inserted in its place. The sight box is shifted on the bar until a balance is again obtained, and the reading on the ratio scale gives the ratio between the reflecting powers of the sample and of the standard test plate. As many of the samples tested are colored, all inaccuracies due to color effect with this form of screen are introduced, but the process is useful where it is desired to obtain data on wall finishes in schoolrooms and the like. Many decorators have the habit of mixing a small quantity of black into their tints for reasons best known to themselves. This adulteration, while not apparent to the eye, reduces the reflection coefficient very materially, and such points are detected very easily by the foregoing method.

In making photometric tests of arc lamps the Boston Edison Company uses a counterbalanced steel frame carrying two plate-glass mirrors and rotating about an axis. One mirror is placed with its center at the axis of rotation and the other at the end of the frame, the radius of swing being about 6 ft. The lamp to be tested is placed with its center at the axis of the frame and behind the central mirror. The light from the lamp is reflected from the mirror at the end of the arm to the mirror at the axis, and from there upon the photometer bar, which is placed at a height which brings it opposite the center of this mirror. The first mirror may thus be swung about the lamp so as to receive the light coming from any angle, the central mirror always being in the correct position to receive the reflected rays and direct them to the photometer screen. A device of this kind is useful in making tests of candle-power in one direction or in obtaining a curve showing the distribution of light around an illuminant. When it is desired to obtain measurements of the mean spherical candle-power the integrating sphere is employed.

The integrating sphere, consisting of a hollow metal ball having for arc lamp work a diameter of about 2 m, is coated inside with a flat white paint and a small opening is provided in one side into which is fitted a window of diffusing

glass. The lamp to be tested is placed inside the sphere and an opaque white screen is placed between it and the window, so that the direct rays from the lamp are prevented from falling on the latter. When these conditions are obtained the illumination on the window is proportional to the spherical candle-power of the lamp inside the sphere. The constant of the latter is obtained by introducing an incandescent lamp the spherical candle-power of which has been previously determined. On the outside of the sphere an arrangement is provided for comparing the illumination of the glass window with a standard lamp.

Measurements of foot-candles are made on the street by the Boston Edison company by means of a photometer carried on a tripod and consisting essentially of a screen and mirror equipment arranged to receive and compare the light from the external source with that given by a 6-volt, 4-watt tungsten incandescent lamp which has previously been calibrated for different values of current. The lamp is connected in circuit with a milammeter, a "doughnut" type rheostat and a battery of dry cells, and it is usually operated somewhat below the full voltage rating of the filament in order to maintain the accuracy of the calibration. The latter, on the portable photometer, gives the observer the foot-candles of illumination on the screen corresponding to the variations in current, the reading of the photometer scale being referred to a curve carried with the outfit.

SUIT TO REMOVE RIVAL COMPANY'S LINES.

The Glenwood Springs (Col.) Light & Water Company has brought suit against its recently organized competitor, the Mutual Light, Heat & Power Company, also of Glenwood Springs, asking the federal court to grant an injunction enjoining the Mutual company from maintaining its wires and poles on the same side of the streets and alleys as its own circuits. The Glenwood company, which began operation in 1888, declares that the high-tension lines of its rival are in such proximity as to endanger its property and the lives of its employees. A recent expert inspection of the parallel lines of the competing central stations revealed the fact, as reported in these columns, that primary and secondary lines were in some places only a few inches apart, involving a condition of large fire and life hazard to the consumers of both companies. The suit already filed may result in a number of similar suits if the complainant company is successful in ousting the defendant's lines from its own side of the alley.

EXTENSIVE OPERATIONS OF THE MIDDLE WEST UTILITIES COMPANY.

Recent information obtained from reliable sources in relation to the extensive operations of the Middle West Utilities Company of Chicago, all within the last six months, is of much interest. The purpose of the company is to acquire public-utility properties, particularly in the smaller cities and towns, and to organize and own subsidiary state companies to take over and operate the properties acquired in their respective states. In pursuance of this plan the company, through its subsidiaries, has already purchased a considerable number of public utilities in communities of medium size in several states. At present this plan of operation has been particularly developed in the State of Illinois, and more or less in Indiana, Kentucky, Oklahoma, Missouri and in some of the New England States. The number of communities served and properties controlled in various states, with the class of service, is given in the accompanying table, which does not include a number of properties upon which the company has options.

In each of the states or group of states mentioned in the following table there is or will be a separate operating subsidiary company of the Middle West Utilities Company. The first of these subsidiary companies was the Central Illinois Public Service Company, which has taken over utilities in eighty-seven communities in central, southern and western Illinois. Forty-nine separate generating plants have supplied the territory of this company. These plants are being gradually shut down, and the whole territory will within a very short time be served by the transmission lines of the company from perhaps eight plants, and ultimately

DATA OF OPERATIONS OF MIDDLE WEST UTILITIES COMPANY.

	Illinois.	Indiana.	Kentucky.	Missouri.	Oklahoma.	New England.	Total.
Number of communities served	97	16	7	2	2	16	140
Electric light and power	97	16	7	2	2	16	140
Gas	4	8	1	2	....	4	19
Heating	10	3	....	....	....	....	13
Ice	10	1	4	....	1	....	16
Interurban railways	2	2	....	....	....	....	4
Street railways	6	3	1	....	....	1	11
Water	9	4	3	....	....	....	16
Population served	250,000	120,000	30,000	15,000	40,000	80,000	535,000

this number will be reduced probably to four or five plants. The company is now building at Kincaid, at the mouth of one of the largest coal mines in the State, in the center of the coal-mining district of Christian County, a steam generating station of modern design and of exceptional location both as to fuel and water. This plant is being designed by Sargent & Lundy, of Chicago, and it is expected to show exceptional economy in the production of electrical energy. Ultimately it will be tied to the general transmission system of the Central Illinois company.

The Central Illinois Public Service Company controls the Central Illinois Traction Company, which owns and operates an interurban electric railway between Mattoon and Charleston, Ill.; has also interurban franchises in the towns of Paris, Kansas and Ashmore, Ill., and owns and operates the local-street railway line in Paris, Ill. It is contemplated later to continue the interurban railway from Charleston to Paris, Ill., and this extension, when completed, will connect with an interurban line now operated between Paris and Indianapolis, thereby giving through electric service from Mattoon, Ill., to all interurban points in Indiana, Ohio and Kentucky.

A company will be organized soon by the Middle West Utilities Company to take over the properties controlled in Indiana. An important group of these properties is in or near New Albany, Ind., across the Ohio River from Louisville, Ky. These properties practically control the entrance of interurban electric cars into the city of Louisville from all northern points. The Interstate Public Service Company, which is a subsidiary of the Middle West company, controls over 60 miles of interurban railway in the central part of Indiana. In addition to extensive electric railway interests in Indiana subsidiaries of the Middle West company own the utilities in many of the towns served by the interurban lines. These utilities will be connected together by transmission lines and served by a central generating station which will also supply the interurban railways. In addition, the subsidiary companies in Indiana own utilities in towns not on the lines of their interurban railways and are now negotiating for other plants or franchises in accordance with the general policy of serving large groups of small communities from a central power station.

Kentucky has as a subsidiary company the Kentucky

Utilities Company, most of the properties of which are located in the "Blue Grass" region. The Kentucky company controls the utilities in Shelbyville, 23 miles from Louisville, and also in Somerset. In Kentucky one feature of the business will be supplying electricity or gas, or both, to many of the extensive stock farms for which the State is noted.

The New England company, which is not designated more particularly in the circular from which these facts are taken, operates in the States of New York, Vermont, New Hampshire and Maine and is spoken of as having a gross income of $325,816 last year. The New York and Vermont divisions of this company's business are connected by transmission lines serving as tie lines to connect two generating stations. Both of these divisions are supplied by hydroelectric plants with steam auxiliaries. The generating station of the New Hampshire division is a steam plant located at tidewater, and it also transmits electrical energy into Maine. The New England company also owns and controls gas and street railway properties.

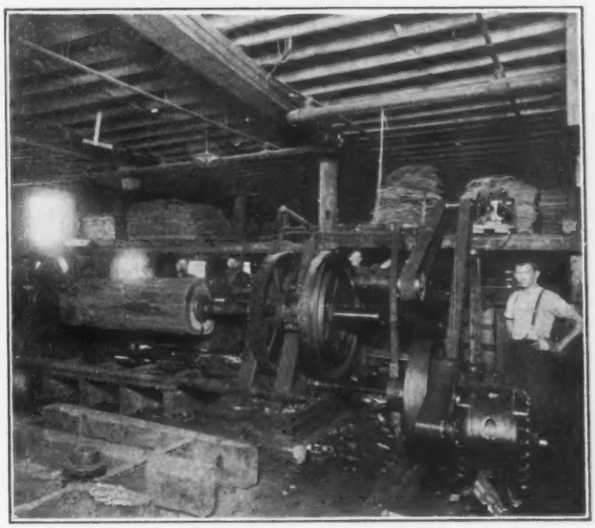
As to the financial aspects of this large organization, it is interesting to note that the entire capitalization is represented by 6 per cent preferred stock and common stock. The authorized issue of preferred stock is $12,000,000, of which $5,000,000 has been issued, and the authorized issue of common stock is $12,000,000, of which $7,000,000 has been issued. The subsidiary companies are independently financed by selling a reasonable amount of bonds on the group of properties they respectively operate, thus returning to the treasury of the Middle West Utilities Company a part of the capital it originally invested in them. The junior securities of these subsidiaries are retained by the Middle West company and represent its permanent equity in the companies. It is the company's policy to keep these junior securities intact in its treasury as far as possible. In addition to the income from the securities of its subsidiaries the Middle West company will have quite a large income from trading in and participating in the underwriting of the securities of other public-utility companies. It will also receive considerable profit, it is believed, from financing, engineering and supervising its subsidiary companies. It is declared to be the policy of the directors of the Middle West Utilities Company that whatever profits are made in any operations affecting the company shall go directly into its treasury whether these profits are made from financing, underwriting, engineering, construction, management or supervision.

Irrespective of the profits to be obtained in this manner, the earnings of the Middle West Utilities Company from the operation of its subsidiary companies for the year preceding the date of the audits of Arthur Young & Company and other public accountants were $465,011. This sum, it should be explained, is made up as follows: Surplus applicable to dividends on stock of subsidiary companies held by the Middle West company, $369,371; proportion of interest on bonds, $71,180; interest and dividends on securities of other than subsidiary companies, $24,460. The gross earnings of the subsidiary companies were $3,948,812; net earnings, $1,297,302. These earnings, however, were made previous to the acquisition of the properties by the Middle West company. With more efficient supervision and operation it is believed that the gross earnings will be increased and the proportionate cost of operating reduced.

It is estimated that the total earnings on securities held by the Middle West Utilities Company during the calendar year 1913 will be $845,000. It was organized under the laws of Delaware in May, 1912, by Mr. Samuel Insull and his associates, and its principal office is in Chicago. Mr. Insull is the president of the company and the vice-presidents are Messrs. Martin J. Insull, John F. Gilchrist and Frank J. Baker. Mr. Edward J. Doyle is the secretary. The directors, in addition to the five gentlemen named, are Messrs. Louis A. Ferguson, William A. Fox, John H. Gulick, Frank T. Hulswit, William J. Maloney, Charles A. Munroe, F. S. Peabody, Edward P. Russell, Marshall E. Sampsell and Frederick Sargent. Mr. Hulswit is president of the United Light & Railways Company; Mr. Peabody is president of the Peabody Coal Company of Chicago and is a large coal producer, and Mr. Sargent is the well-known consulting engineer.

MOTOR-DRIVEN ROTARY VENEER CUTTER.

The rotary veneer cutter illustrated has a 100-in. knife which shaves off a continuous strip of veneer as the hardwood log is rotated on the huge lathe. By an adjustment of the feed the thickness of wood removed can be varied down to 1/16 in. The main drive of this 100-in. Coe rotary cutter is effected by the 35-hp motor in the foreground through chain gearing and a friction clutch. On the gallery



Motor-Driven Rotary Veneer Cutter.

is seen the 5-hp motor, with extended shaft and outboard bearing, which operates the two feed motions. The hardwood log hides the long sharp knife in the picture. As the veneer comes from the cutter it is cross-cut into desired lengths for furniture finishing. The installation is that of the Louisville Veneer Mills, which purchase their electrical energy from the Louisville Lighting Company.

BILLS FOR CHRISTMAS APPLIANCES PAYABLE FEB. 1.

To encourage its customers in the selection of electrical Christmas gifts, as well as to insure the early purchase of these presents, the Denver Gas & Electric Company will defer until Feb. 1, 1913, rendering bill for all appliances bought during the first sixteen days of December.

This means that customers who bought electrical gifts early will not have to pay for them until the usual stringency in Christmas funds has been relieved. The offer was explained in detail in a letter written by Mr. Clare N. Stannard, commercial manager of the company, to individual customers under date of Dec. 3. Among the appliances featured by the Denver company under this deferred-payment plan were coffee percolators, egg boilers, tea kettles, heating pads, boudoir lamps, library lamps, chafing dishes, curling irons, bread toasters, electric irons, electric stoves, luminous radiators, etc.

Wiring and Illumination

COST OF UNDERGROUND CONDUIT CONSTRUCTION.

The following data bearing upon the cost of underground conduit construction in a New England city of 40,000 inhabitants are of interest, as the work was done with careful engineering and completed within the past three years. The total cost was $141,800, consisting of conduits, manholes and service ducts, $85,000; cables, $48,000, and miscellaneous expenses, $8,854. The items in detail were as follows:

CONDUITS, MANHOLES AND SERVICE DUCTS.		
23,393 ft. of conduits, containing 257,300 duct-ft....	$63,940	
141 manholes.....	16,600	
8927 ft. of service duct in 270 connections to buildings, poles, etc.....	4,460	$85,000
CABLES.		
Street lighting:		
104,900 ft. of No. 6 cable.....	$14,400	
Secondary light and motor service:		
18,000 ft. of No. 4-0 cable, 30,000 ft. of No. 1-0 cable, 8000 ft. of No. 2 cable, 12,000 ft. of No. 6 cable....	13,300	
7000 ft. of No. 1 bare wire, 15,000 ft. of No. 2 bare wire, 4000 ft. of No. 5 bare wire, 6000 ft. of No. 8 bare wire.....	1,100	
Installation of above cables and wires, including materials, apparatus and supervision.....	9,200	38,000
Primary lighting circuits:		
18,530 ft. of No. 2-0 cable, 12,450 ft. of No. 1-0 cable, 9780 ft. of No. 4 cable.....	$8,100	
Installation of these materials and supervision included.	1,900	10,000
Miscellaneous expense on service connections to 73 poles and lamps and rewiring 197 buildings.....		8,854
Total.....		$141,854

The average cost of conduit was about 25 cents per duct-foot, including excavation, back-filling and conduit complete ready for cables, with maintenance of the street above the conduit for one year. The manhole walls were of brick, laid in cement, 8 in. to 12 in. in thickness, varying in depth from 3 ft. to 12 ft. Primary cables are installed in the same conduits as other service mains but in different ducts. Services averaged about 50 ft. in length, the individual costs running from 20 to 30 cents per foot.

SAFETY RULES FOR ELECTRICAL CONSTRUCTION.

Among the provisions pertaining to electrical apparatus in the booklet of safety rules just issued by the Inland Steel Company, Indiana Harbor, Ind., are the following, designed to protect human life and limb, as well as to facilitate operation about the mills:

Ground wires shall be provided for frames and bedplates of generating machines, all electrically driven machinery, motors, switchboard frames and railings, etc.

Incandescent lamps or clusters of 150 watts capacity and over, with reflectors or shades, shall be suspended by conduit, rod or other substantial support and not depend upon electrical feed wires for support.

Conductors shall be of rail, bar or structural shape wherever practicable, so located, protected or guarded as to minimize the danger to men working near them. Wherever practicable they should be painted yellow to distinguish them from ordinary structural work.

There shall be not less than 4 ft. actual clearance between equipment on back of board and the wall or other structures, and the ends of this space shall be guarded by railings or screens which will permit clear view of space back of board. There shall be no doors, cupboards, storage or obstruction of any kind behind boards, and this space shall not be used as a thoroughfare. No live parts carrying a potential of over 275 volts shall be mounted on face of panels.

All exposed parts carrying a potential of from 275 volts to 1000 volts shall be painted blue, and those carrying over 1000 volts shall be painted red, so as to make them easily distinguishable.

Signs warning of danger shall be placed on all poles carrying current at 275 volts or over. Where a lower voltage is carried on the same pole a high-tension danger sign shall be mounted on or immediately below the lowest cross-arms carrying the high voltage.

On overhead transmission lines or open main wiring inside buildings different types of insulators shall be used for each separate class of service, so as to make the circuits easily distinguishable for reasons of safety as well as operation.

No live wire of any voltage shall be exposed in manholes

ORNAMENTAL STREET LIGHTING AT SENECA FALLS, N. Y.

To anyone who has followed the progress of electrical development it is clear that a revolution in the methods of illumination for public streets is under way. The larger

Fig. 1—Five-Lamp Standard at Seneca Falls, N. Y.

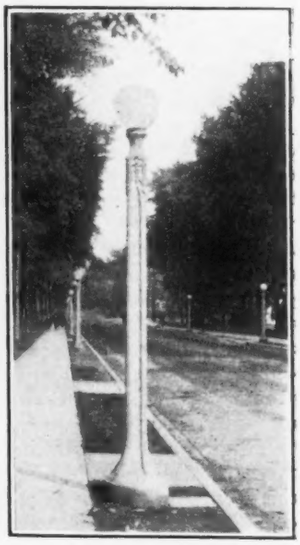


Fig. 2—Single-Lamp Standard at Seneca Falls, N. Y.

cities have made great strides, as evidenced by the changes made in New Haven, Conn.; Utica and Rochester, N. Y., and Chicago, Ill., the latter having installed ornamental posts with very high-candle-power lamps to supersede the inclosed-arc lamps in the business sections. This method is much too expensive for small cities and villages, and other means of bringing about a change must be sought. The problem has been solved in one town in New York and the results may be of interest.

Seneca Falls has a population of approximately 7000 and possesses two main streets. These were previously lighted by 6.6-amp inclosed-arc lamps, together with a line of five-lamp ornamental posts on one main street, which were illuminated until 10:30 p. m. (Figs. 1 and 2). With the usual line of wooden poles, this system does not present a very attractive appearance by day, and at night the poles throw shades which materially reduce the lighting effect. The company operating at Seneca Falls was asked to recommend a system for the remaining business street that would

be ornamental by day and give an even distribution of light by night. After a study of the situation, inquiries were made to determine what constitutes a system attractive in the daytime and of reasonable cost. Fortunately, the engineers of the Rochester (N. Y.) Railway & Light Company had been making studies of posts, and after many experiments, had selected a concrete post (Fig. 3) surmounted

Fig. 3—Five-Lamp Standards at Night.

with a brass cap dipped in acid to impart a verdigris effect and bearing on top of the cap a 16-in. ball globe.

Two of these posts were purchased and erected in Seneca Falls. The municipal authorities were so pleased with them that orders were given to install twelve of them on one street at once. The posts are spaced 98 ft. apart on each side of the street and staggered so as to impart a uniform degree of illumination throughout the distance lighted (Fig. 4). These lamps have now been in operation about three months, and the results have been so satisfactory that the village lighting committee, alive to the needs of the town and with a view to making an attractive night and day display, has ordered twenty-five additional posts for immediate installation and will order more later, as soon as the funds are available.

The plan for street lighting in Seneca Falls will in future call for the elimination as far as possible of the old-style arc lamp and of the unsightly incandescent pole fixture. Indeed, the company is so firm in its belief in this proposition that it has constructed a plant in Seneca Falls for the purpose of manufacturing the posts for use there as well as elsewhere in the territory served by it. The lamps are of

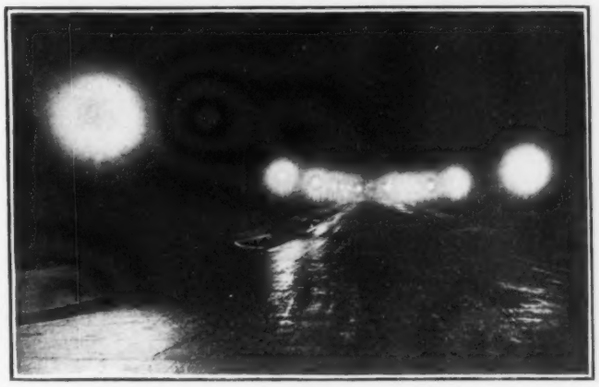


Fig. 4—Single-Lamp Standards at Night.

the 6.6-amp series type, rated at 60 cp, and are connected to the regular arc circuit by means of a lead-covered single-conductor No. 8 cable laid in fiber conduit placed about 1 ft. below the surface of the sidewalk and just inside the curb line. The lamps burn all night on the *Electrical World* schedule and cost the village $24 each a year. The cost of installing the first set was much higher than the present cost, owing to subsequent changes in the method of installation and materials used. Approximately, the cost was as follows:

Total cost per post erected	$74.51
Total cost per foot of cable laid	0.7384
Total annual cost of new lighting to the village	288.00
Previous annual cost of lighting same district with arc and incandescent lamps	158.00

It will be evident from the foregoing that the village of Seneca Falls is obtaining with this system a very much better distribution of light at a somewhat higher expense. In view of the results obtained and the satisfaction on the part of the village authorities, it has been thought to be "good business" to encourage the more general use of this method of street lighting, which is attractive, ornamental and a good advertisement for the Central New York Gas & Electric Company and for the village. The Central New York Gas & Electric Company operates in Geneva, Waterloo, Seneca Falls, Phelps, Newark, Palmyra, Lyons and Clyde, N. Y. Mr. A. V. Wainwright is the general manager. The main office of the company is located at Geneva.

THE TENDENCY IN MODERN WINDOW LIGHTING.

In Europe quite a number of large retail stores are springing up, patterned after the American department

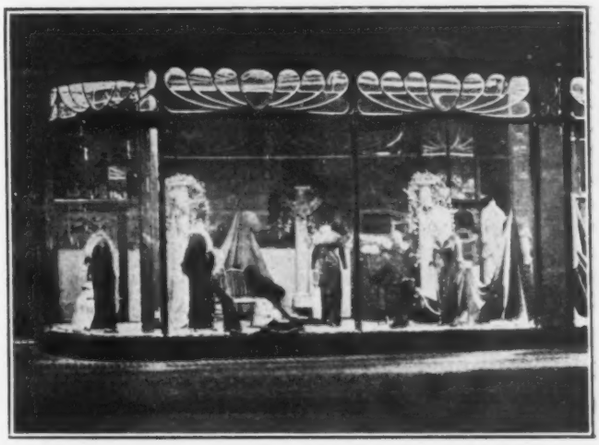


Fig. 1—Window Illumination by Concealed Lamps.

store. Several have recently been established in London, and the method of lighting the windows is becoming a matter of great interest to illuminating engineers. The modern tendency in such cases is undoubtedly toward making the actual means of lighting unobtrusive, since the illuminated goods are the important thing. Concealed lamps in specially designed reflectors are therefore becoming usual. The form of reflector used naturally depends on the dimensions of the window, special designs being sometimes necessary when the window is very deep.

At the same time that window illumination has been developing on these lines the method of dressing windows has also undergone a revolution. The present tendency in England is not to crowd the window with a heterogeneous collection of articles forming something like a catalogue of contents, but rather to allow plenty of space, showing only a few choice samples. Window lighting on these lines is much more artistic. Moreover, when the public comes to recognize that the contents of a window are constantly changing it becomes interested. People know there will always be something new to see. It may be added, also, that this style of dressing is much more favorable to the illumination. Nothing is more difficult than to illuminate a window in which the goods are all crowded close up to the front glass. If the entire window is filled, each article casts a

shadow when lighted from above and therefore tends to screen the light from other objects near it.

A recent article in the *Illuminating Engineer* (London) which contains several illustrations of the lighted windows of Harrod's stores, a large and well-known establishment in London, draws attention to these facts. In Figs. 1 and 2 some typical windows are shown, and it will be noticed

Fig. 2—Window Illumination by Tungsten Lamps in Mirror-Glass Reflectors.

that concealed light sources are here very effectively employed. The pictures give a good idea of the arrangement of the goods and the bright illumination, but they do not, of course, bring out the vivid coloring of some of the displays. It may be mentioned that the frontage of these stores occupies about 400 ft. and the whole line of windows is kept illuminated until 11 o'clock each night. This plan of keeping the windows alight after hours is becoming very usual in London. Well-lighted windows are much more attractive at night time than during the day and "stand out" better. An effectively dressed and lighted window is one of the best advertisements which a retail merchant can devise.

SEMI-INDIRECT LIGHTING OF A CHICAGO BANK.

Translucent "alabaster" semi-indirect lighting fixtures have been used effectively in re-equipping the room occupied by the bond and savings departments of the First Trust and Savings Bank, Chicago. The illumination fur-

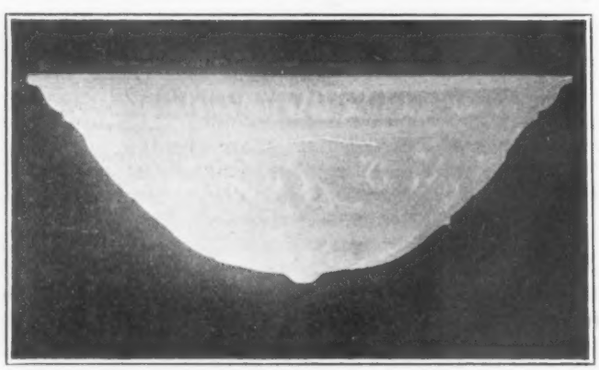


Fig. 1—Detail of Semi-Indirect Bowl.

nished by these units is essentially general and decorative, the working light for the writing desks and tellers' cages being supplied by reflector lamps.

Twenty-eight of the semi-indirect fixtures are employed to light the room, which is, roughly, 60 ft. wide by 130 ft. long. Each fixture contains four 60-watt tungsten lamps. The light from these units reaches the working plane both directly through the diffusing medium of the heavy Alba bowls and by reflection from the ceiling, which is tinted a cream color. The bowls measure 24 in. in diameter and are supported by four bronze chains from the canopy, 42 in. above. These bowl fixtures take the place of the clusters formerly employed and are controlled from flush push switches in the walls near the respective units, enabling any part of the installation to be lighted at will. The same type of lighting is used both in front and behind the cashiers' cages. Desks and counters are, however, locally illuminated by reflector lamps, the semi-indirect fixtures being relied on only for the general lighting. In the trust department on the opposite side of the building fixtures of the exclusively indirect type have been employed, while the counters and cages are lighted by the Frink bank system.

The effect of the new semi-indirect fixtures has worked a pleasing transformation in the appearance of the savings department. The semi-indirect units avoid both the glare of exposed light sources and the inevitable black bowls of suspended indirect units. The translucent bowls employed measure from 0.5 in. to 0.375 in. in thickness and when lighted are transfused with a uniform intensity which conceals the lamp filaments within, at the same time admitting the diffused passage of the light with minimum loss. The general effect is very handsome and has been the subject of

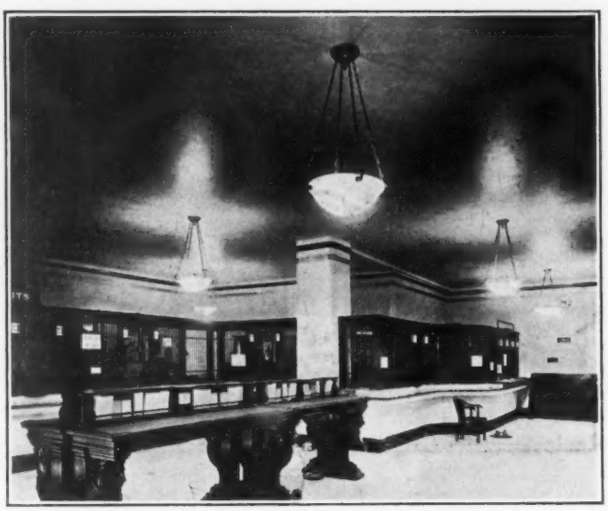


Fig. 2—Semi-Indirect Illumination of First Trust and Savings Bank, Chicago.

comment of many patrons of the First Savings Bank. The fixtures were furnished by the T. W. Wilmarth Company, Chicago, the Alba bowls being supplied by the Macbeth-Evans Glass Company.

TAGGING METER LOOPS.

The meter department of a large Western central-station company which keeps ten or more wiremen busy wiring old and new houses, apartments, etc., employs one man whose sole duty is to check and tag meter loops after the wiring is in place. Aluminum name tags are used for this purpose, the company having purchased outright, for $35, a stamping machine similar to those familiar coin-operated devices installed about railway stations and other public places. The aluminum strip out of which the plates are punched costs about 75 cents per pound, making the tags inexpensive as well as durable. The tag inspector first visits the job while the wiring is being installed and traces out the various circuits, making notes of the labels needed. Returning to the office, he stamps out the names on the plates, and on the next day he affixes the tags.

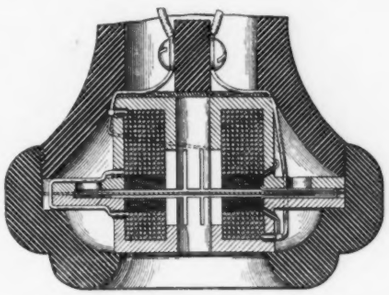
RECENT TELEPHONE PATENTS.

TELEPHONE SYSTEMS.

Mr. H. P. Clawson, of Chicago, has devised a common-battery system with which local battery sets may be used without the necessity of changing the switchboard wiring and without permitting a constant flow of current through the receiver of the local set. This result is accomplished by shunting the receiver circuit of the local battery set with an impedance coil to carry most of the direct current and by including in the receiver and bell circuits a three-way condenser, one terminal being connected to the bell, one to the receiver and one to line. The switchboard circuit is one in which the line relay is shunted by a low-wound supervisory relay in the cord circuit, no cut-off relay being required. This patent is assigned to the Stromberg-Carlson Telephone Manufacturing Company.

RECEIVER.

An electromagnetic receiver has been invented by Mr. L. W. Carroll, of Riverside, Ill. The entire mechanism of the receiver is mounted in a cup of magnetic material and adapted for mounting within the flared end of the receiver shell. The windings are disposed on both sides of the



Telephone Receiver.

diaphragm, the latter lying between two concentric, hollow, slotted poles. Surrounding each of these pole pieces, but out of contact with them, are two windings. At the base of each is a high-impedance, low-resistance exciting winding, while near the diaphragm on either pole is a high-resistance, low-impedance actuating winding. The arrangement of the parts is well shown in the illustration.

Letters to the Editors

A NATIONAL ELECTRICAL TESTING LABORATORY.

To the Editors of the Electrical World:

SIRS:—As is well known, municipal electrical codes provide rules for only the wiring and installation of electrical equipment. But the safety of an installation depends not only on the method of doing the work but also on the quality of the supplies and fittings used. The most available information now to be had concerning the quality and safety of electrical fittings consists of the findings of the Underwriters' Laboratories. Hence, in safeguarding electrical installations against faulty equipment, municipal inspection departments, in the absence of other information, are enforcing the findings of the Underwriters' Laboratories. These findings on electrical fittings are either positive approvals or rejections. The enforcement of these findings by municipal, and sometimes state and federal, inspectors is uniformly rigid. The result is that the Underwriters' Laboratories dictate absolutely what electrical equipment shall be used by the people of this entire country, and the dictates of this private corporation, which is in no way controlled or supervised by the government, are enforced absolutely by government officials.

Without questioning the integrity of the Underwriters' Laboratories, I believe that this is a condition that is entirely wrong in principle. That public officials should enforce the mandates of a private unrestricted corporation, whether through choice or necessity, is entirely against our ideas of right. Furthermore, this action by public inspection departments places a tremendous power in the hands of the Underwriters' Laboratories to discriminate between manufacturers. While I do not claim that this discrimination exists, nevertheless the easy possibility of such discrimination does exist.

I believe that the best solution of this difficulty lies in the establishment by the federal government of a testing laboratory whose activities shall parallel those of the Underwriters' Laboratories. City or state laboratories of this character are undesirable because of the expense, the unnecessary duplication of work and the diversified findings that might result, which would handicap the manufacturers of electrical equipment. The acceptance of the findings of such a laboratory need not be made obligatory upon cities or states. To obviate any legal difficulties, the laboratory may be established for the ostensible purpose of determining what equipment is suitable for use on government work. The findings of this laboratory can then be legalized by any city or state that cares to do so.

I furthermore believe that the establishment of such a laboratory would encourage small manufacturers, stimulate competition and bring down the prices of some lines of electrical fittings.

The difficulty might also be solved in another way if the Underwriters' Laboratories should consent to government supervision. The government control and supervision of these laboratories would justify the enforcement of their findings by municipal inspection departments.

M. SARBINSKY,
Cleveland, Ohio. City Electrician.

METHODS OF COMPUTING DEPRECIATION.

To the Editors of the Electrical World:

SIRS:—From your editorial discussion of my "unit-cost depreciation formula," in your issue of Nov. 2, I see that I did not elucidate certain features sufficiently. I also see that it would have been well had I discussed the effect of depreciation in calculating "development cost" or "going value."

Speaking of the "unit-cost depreciation formula," you say:

"As a calculation to determine the most that a second-hand machine would be worth to a given purchaser, the method seems flawless, but to say that such a calculation fixes in every case the present or depreciated value of a plant or machine is a proposition which is hardly proved by the presentment of the case. Clearly the method requires modification when it results in a negative present value, or a value less than the scrap or salvage value, as it may do. Notwithstanding these defects, and others which arise from disregarding financial, legal and physical factors in depreciation, the method is decidedly interesting."

That the fact of the formula yielding in extreme cases a minus "depreciated value" is a merit rather than a defect will be seen if one considers that many machines in actual use are worse than valueless. It has frequently been said of British manufacturers that one of their inherent weaknesses is inability to see that much of their machinery is a source of loss because more modern machinery would greatly reduce their unit costs of production. The same thing is not infrequently seen in public service plants, where certain plant units are so depreciated as to have a minus

value so long as they continue to be used. Is it not, therefore, a merit rather than a defect when a depreciation formula discloses this condition? Indeed, does not the failure to disclose such a condition prove that a depreciation formula is defective? Neither of the two most commonly used depreciation formulas—the straight-line and the sinking-fund—shows when a machine has attained a condition of minus value—a profit-losing condition; and this alone serves to prove the lack of generality in those two formulas.

Regarding any defects in the "unit-cost depreciation formula" that "arise from disregarding financial, legal and physical factors," I think you must agree with me that if such defects exist in my formula they also exist in the straight-line and in the sinking-fund depreciation formulas. However, I do not know of either "financial or legal factors" that are to be considered, unless you refer to stipulations in contracts, franchises or laws. Laws on depreciated value, as far as I know, are not restrictive as to the method to be used in estimating accrued depreciation, nor have I seen any contract or franchise that prescribed a particular method.

In speaking of disregard for "physical factors," I take it that you mean such physical conditions as an inspection may disclose. If so, the same disregard of "physical factors" may be raised as an objection to every depreciation formula. I would not be understood as advocating the universal substitution of a depreciation formula for inspection. There are many cases where nothing but an inspection will disclose the depreciated condition of a plant unit. On the other hand, there are many other cases where inspection—at least such as it is practicable to apply—cannot yield as accurate results as with a depreciation formula. Thus, given the ages of all the cross-ties in a railway, their depreciated value can be much more closely estimated by the aid of a depreciation formula than by inspection. Inspection, moreover, cannot ordinarily be used to determine functional depreciation with any degree of accuracy.

In my article on depreciation I did not emphasize sufficiently the fact that the "unit-cost depreciation formula" is an economic depreciation formula founded on a premise that cannot be successfully assailed. The "sinking-fund depreciation formula" also purports to be an economic depreciation formula, but its premise lacks generality and can be successfully disputed in every case where maintenance expenses rise as the plant unit grows older. However, there are many classes of plant units whose annual maintenance expense is either almost nothing or is nearly constant. In that case, the "sinking-fund depreciation formula" applies correctly, for it is a special case of the "unit-cost depreciation formula." I regard this as a very important deduction, for it establishes definitely the limitations and the correct uses of the "sinking-fund depreciation formula," which have hitherto been a matter of dispute.

The "straight-line depreciation formula" always gives a greater accrued depreciation than the "sinking-fund depreciation formula." Hence there have often been acrimonious disputes between the respective defenders of these two formulas. Each side has been able to indicate the fallacies in the contentions of the opposite side. The sinking-fund exponents have argued, for example, that the first year of life of a machine is worth more to its owner than its last year of life, not only because repairs are less in the beginning, but because delays from breakdowns are fewer. Yet the "straight-line depreciation formula" ignores entirely this self-evident condition and rates one year the same as another—the last year the same as the first. Never has a defender of the straight-line formula been able to answer this objection. But, as is usual when the logic of defense fails, a counter blow is delivered—the logic of the attacker is attacked. The straight-line formula exponents have pointed out that the sinking-fund formula also fails to include a factor for current repairs, and that it is merely begging the question to point to the rapid building up of the fund at the end of life of the plant. A sinking fund can never, of itself, possess any logical relation to actual repair expenses. This objection to the generality of the sinking-fund depreciation formula has never yet been answered by one of its defenders.

In brief, both of the old depreciation formulas pretend to show the economic depreciation—for what is depreciation if it is not economic loss? Yet both of the old depreciation formulas fail to contain a factor to provide for the effect of a rise in annual maintenance expense toward the close of the life of a machine, and thus fail to give consideration to an important economic condition.

The "unit-cost depreciation formula" does take into consideration the economic effect of a rising curve of repair expense, for it is predicated on this broad economic principle: The criterion of value of a machine is the cost per unit of service that it will render during its remaining life.

If it is objected that this criterion introduces the element of cost where we are really in search of value, I would reply that in this case cost and value are identical. Under open market conditions the value of a given plant unit is the cost of securing an equivalent plant unit that will render the same service. The "unit-cost depreciation formula" is a mathematical tool for use in calculating an equivalency.

The last paragraph must not be construed as an indorsement of the theory that the rate-making value of a public utility is the depreciated value of its property. In my discussion of "Development Cost or 'Going Value' of Public Service Companies" in the June 26 issue of *Engineering and Contracting* it is shown that accrued depreciation of public-utility properties is ordinarily offset, and frequently more than offset, by the development cost.

Chicago, Ill. Halbert P. Gillette.

[Note.—The preponderance of legal authority upholds the principle that in appraisals of property it is present value which is controlling—not the value which existed at some previous time nor that which may be expected in the future, but the value *now,* or substantially as of the date on which the value is in question. In arriving at present values, the use of the unit-cost method which Mr. Gillette proposes might, as he says, result in a negative value in the case of such property as machinery which had become partially or wholly obsolete by reason of advances in the art. The assignment of a negative value amounts to the confiscation of the residual or scrap value of the materials in the machine, and while a computation which shows that the machine is clearly obsolete and uneconomical imparts valuable knowledge, it is not a calculation which discloses the second-hand market value or price of those materials.

The unit-cost method also introduces in the determination of property values questions of the cost of the service rendered by the property, which is affected by considerations of the manner and condition of use of the property and the prices of labor, fuel, supplies, etc. The influence of these factors raises, in our minds at least, some doubt as to the admissibility of the method for the general purpose of valuation.

The failure on the part of an operating company to lay aside a depreciation reserve fund, its equivalent being paid out instead as profits or dividends, amounts to paying profits out of the capital or investment fund, since a depreciation reserve is necessary to preserve the face value of the original investment. Dividend payments from capital, under the guise of profits, are illegal under the laws of some states.

The manner in which depreciation advances with age, and the simultaneous laying aside of a reserve fund to protect the shrinkage in value, are correlated problems. Discussion of them can be prolonged to great lengths, and such discussion is much to be desired; it is simply our purpose here, however, to draw attention to these phases of the general problem and indicate their nature.—Editors.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

High-Speed Dynamo-Electric Machinery.—An account of the discussion which followed the recent paper of F. Creedy on the turbo-converter. Mr. Miles Walker emphasized that it was not impossible to design a direct-current generator to run at a very high speed. Commutators can run at something like 10,000 ft. per minute without any difficulty whatever. The difficulties that have arisen in turbo-generators were not due to the high speed of the commutators but to the fact that sufficient provision had not been made for expansion and contraction. High-speed commutators can be built. Mr. J. S. Peck said that the final solution of the problem of driving a large direct-current generator at very high speeds would be either through a gear-reduction device or through some other speed reduction arrangement such as a rotary converter and an alternating-current generator. Mr. G. W. Worrall stated that the difficulty with a direct-current turbo-generator is not exclusively at the commutator, but to a very great extent it lay between the commutator and the armature. He had observed two particular cases of serious breakdowns; the first was due to broken commutator sections, and the second was the formation of a harbor of dust among the connections between the commutator and the outer coil. In spite of the many difficulties in Creedy's invention and its many objections it should be seriously considered, in view of the fact that the direct-current part of the armature can be run at lower speed.—London *Electrician*, Nov. 22, 1912.

Lamps and Lighting.

Elimination of Color Difference in the Photometry of Incandescent Lamps by Means of Multi-Voltage Standards.—D. H. TUCK.—Candle-power determinations are based on the operation of carbon lamps or tungsten lamps at a fixed efficiency. If these lamps are operated at other efficiencies, the different color resulting makes comparison very difficult. When different observers make photometric measurements on lamps which operate at an efficiency different from that at which the primary or secondary standard lamps are calibrated, different results are obtained and different experienced observers will repeat their readings from day to day. Several combinations have been more or less successfully used to eliminate the difference in the color of the light which falls on either side of the photometer screen,

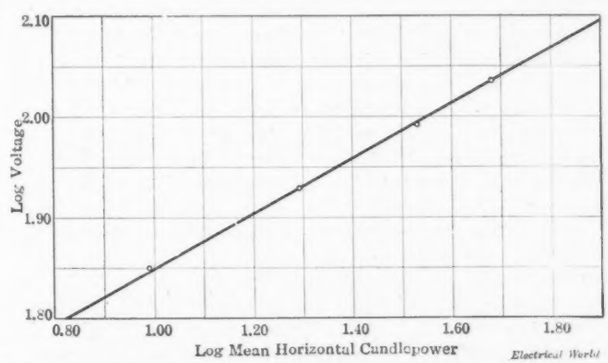


Fig. 1—Relation Between Candle-Power and Voltage Logarithms.

and such combinations are indispensable when a large number of lamps are to be accurately calibrated in a limited zone. By the adoption of the following procedure it is possible to make comparisons of lamps operating at different colors once and for all at some convenient time and to make all subsequent comparisons under the favorable conditions of a color match. A group of tungsten-filament lamps is selected which are so constructed that the filaments are strongly anchored, and at the same time the current comes to a steady value in less than 45 seconds. Select four voltages which will operate these lamps at different specific consumption between 4 watts per mean horizontal cp and 1.25 watts per mean horizontal cp. At these voltages let five or more experienced observers make at least nine

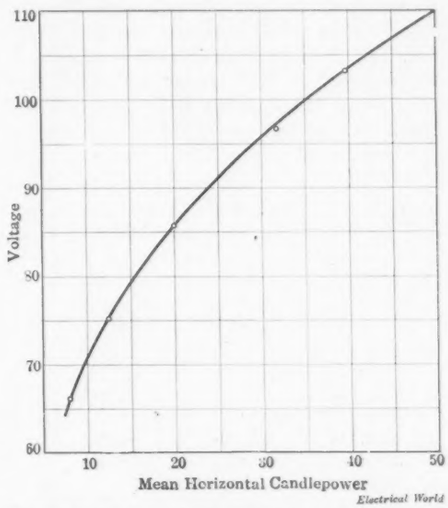
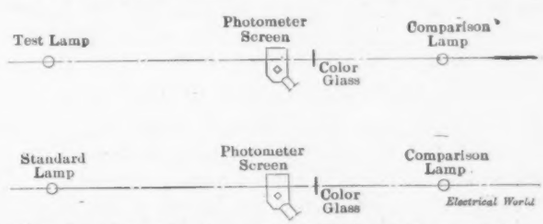


Fig. 2—Variation of Candle-Power with Voltage.

independent candle-power determinations, using carbon or tungsten reference standards. If the logarithms of the voltage values be plotted against the corresponding logarithms of candle-power, the mean values being used, the resulting curve will be a straight line. Such a plot made from the data for a 60-watt tungsten lamp is shown in Fig. 1. If values are read off from the logarithmic plot and the numbers corresponding to these logarithms are plotted into a direct plot, the candle-power voltage curve shown in Fig. 2 may be constructed. When the candle-power voltage curves have been constructed for a group of multi-voltage standard tungsten lamps, all subsequent comparisons of test lamps may be made against these multi-voltage tungsten standards when these lamps are operated at such a voltage as will produce a color match with the test lamps. The procedure is as follows: (a) Using the substitution method, adjust the voltage of the comparison lamp to give a color match with the test lamp when the test lamp is operated at the voltage at which it is to be standardized. If necessary, insert a blue-glass color screen between the photometer



Figs. 3 and 4—Arrangements of Photometric Apparatus.

screen and the comparison lamp. See arrangement No. 1 of Fig. 3. (b) With the voltage of the comparison lamp at the value as found in operation (a) and the color screen, if used, in place, adjust the voltage of the multi-voltage tungsten standards to give a color match with the comparison lamp. See arrangement No. 2 of Fig. 4. (c) Use the multi-voltage tungsten standard lamps at these voltages as

standard lamps with which to compare the lamps that are to be tested. See arrangement No. 1 of Fig. 3.—London *Elec. Review*, Nov. 15, 1912.

Spectral Luminosity Curve of the Average Eye.—H. E. Ives.—An abstract of an American Physical Society paper. Previous papers of the author's series have recorded an extended investigation of methods of heterochromatic photometry. As a consequence of this investigation a set of conditions for colored-light photometry have been suggested for adoption, as follows: (1) The use of the flicker photometer; (2) an illumination of 25 meter-candles; (3) a photometric field of 2 deg. diameter surrounded by an approximately equally bright field of 25 deg. diameter; (4) the use of a normal or average eye. The fourth requirement demands a knowledge of the characteristics of the average eye. To meet this need spectral luminosity curves of eighteen observers have been determined by the method and conditions mentioned. The average value which may be considered as taken by a sufficiently large number of observers to be adopted as standard is given in the following table:

LUMINOSITY CURVE OF AN EQUAL ENERGY SPECTRUM.

0.44μ	0.45μ	0.46μ	0.47μ	0.48μ
0.029	0.047	0.073	0.107	0.154
0.49μ	0.50μ	0.51μ	0.52μ	0.53 μ
0.253	0.363	0.596	0.794	0.912
0.54μ	0.55μ	0.56μ	0.57μ	0.58μ
0.977	1.000	0.990	0.948	0.875
0.59μ	0.60μ	0.61μ	0.62μ	0.63μ
0.763	0.635	0.509	0.387	0.272
0.64μ	0.65μ	0.66μ	0.67μ	0.068μ
0.175	0.104	0.068	0.044	0.026

The figures are the mean of eighteen observers, and the first four and last three figures of the series are extrapolated.—*Physical Review*, November, 1912.

Incandescent Lamps.—A note on a recent British patent (No. 8086, Nov. 14, 1912) of Peter Cooper Hewitt. To diffuse light from a linear source, the filament is surrounded by a diffusing container having a number of narrow, shallow concave grooves, not more than 0.02 in. apart, center to center, approximately parallel to the filament, so that the rays from the source blend in the field of illumination to produce the effect of a uniform wide blaze of light. It is suggested that the container be of brown glass, etched on the outside and smooth inside.—London *Elec. Eng'ing*, Nov. 21, 1912.

Drawing Tungsten Wire.—A note on a recent British patent (No. 9788, Nov. 14, 1912) of the British Thomson-Houston Company, Ltd., and the General Electric Company of this country. When a tungsten rod or wire is being swaged, drawn or otherwise worked it sometimes becomes too brittle or "short" to be manipulated. It is proposed to get over this difficulty by removing the skin by dipping, passing through or otherwise treating the metal in a fusion of an oxidizing salt, or else by grinding or otherwise. After this the working is continued.—London *Elec. Eng'ing*, Nov. 21, 1912.

Generation, Transmission and Distribution.

French Water-Power Stations.—H. Bresson.—An article giving statistical data on the water-power plants along the coasts and frontier of France arranged according to districts. For each plant the chief figures of the equipment are given and a diagram shows the development of these plants for the years from 1880 to 1912.—*La Revue Elec.*, Nov. 22, 1912.

Electric Main Winding Engines.—W. Philippi.—An article illustrated by diagrams on the calculation of the economy in operation of electric main winding engines for mines. The economy depends on the system chosen, the first cost of installation and the power cost, as well as on the quantity of energy used in the winding installation. The principal lines of investigation which must be considered in the calculation of these different factors are indicated, and data are given on the results which have been obtained so far in large electric winding plants in comparison with steam plants.—*Elek. Zeit.*, Nov. 21, 1912.

Traction.

Single-Phase Versus Direct Current for Suburban Traction in Australia.—An account of the results of the tenders for the conversion of the Melbourne suburban lines to electric traction. Complete alternative schemes were prepared on the direct-current and single-phase systems. Some 300 miles of track are involved and about 150,000,000 passenger journeys per annum, while the total cost before the work is completed will probably be nearer $15,000,000 than $10,000,000. The specifications were drawn up in such a way as to make the cost of the two systems absolutely comparable. Direct current at 1500 volts conveyed by an overhead line was specified in the one case and single-phase current and an 11,000-volt overhead wire in the other, the current in each case to be generated as three-phase at 25 cycles and 20,000 volts. Detailed tenders were put forward by the leading manufacturers of both systems throughout the world. The tenders were accompanied by stringent guarantees as to the energy consumption, and the repairs and maintenance costs of the two systems were compared in detail. The result has been a somewhat remarkable victory for the direct-current system. For a suburban system of 300 track miles with a schedule speed of 21 miles per hour and a traffic of 150,000,000 passenger journeys per annum the single-phase system is some $3,500,000 more expensive in first cost and some $350,000 a year dearer in annual cost. Electric traction may not, however, in future be confined to the suburban railways, and the Melbourne authorities have carefully considered the question of system in relation to the country lines as well, in view of their possible subsequent electrification. Alternative schemes have, therefore, been prepared for typical lines up to 100 miles distant from Melbourne. For a country line 100 miles long, such as that to Bendigo, with a traffic of rather less than 2,000,000 passenger journeys per annum and a freight traffic of about 1,600,000 tons per annum, the installation of the single-phase system would cost "a few thousand pounds" more than that of the direct-current system, while the annual cost may be said to be practically the same. Two features which reduce the cost of the direct-current system are the exceptionally high voltage for the trolley wire and the use of the overhead line.—London *Electrician*, Nov. 22, 1912.

Ship Propulsion.—A note on a recent British patent (No. 28,512, Nov. 14, 1912) of the British Thomson-Houston Company, Ltd., and the General Electric Company of this country. A number of induction motors driving the propellers are supplied with current from a number of polyphase induction generators, with a less number of poles, driven by high-speed turbines. An auxiliary synchronous generator, driven by an adjustable-speed motor or turbine, is provided for setting the phases of the main generators. Means are provided for connecting the generators in parallel to the motors and for connecting them in concatenation for low ship speeds for maneuvering.—London *Elec. Eng'ing*, Nov. 21, 1912.

Installations, Systems and Appliances.

Laying Out Angles in Transmission Lines.—An illustrated description of three very simple trigonometric methods for rapidly determining the angle through which the direction of a transmission line in course of plotting must be deviated at a certain place.—London *Elec. Review*, Nov. 15, 1912.

Electrophysics and Magnetism.

Electromagnetic Induction and Relative Motion.—S. J. Barnett.—A new discussion of the old problem of unipolar induction. A magnet symmetrical about its axis and

rotating about this axis uniformly is touched in two points *A* and *B* not in the same equatorial plane by the ends *A* and *B* of a wire *ACB*. A steady current traverses the circuit thus formed. Which is the seat of the emf, the wire or the magnet? That is, do the lines of magnetic induction rotate with the magnet and cut the external conductor *ACB*, or do the lines, like the external conductor, remain fixed while the magnet rotates through them? The author tried to solve the problem by the following method: A cylindrical condenser is placed in an approximately uniform magnetic field parallel to its axis, and the magnets producing the field are rotated while the condenser is short-circuited by a wire at rest like itself. While the magnets are still rotating the connection between the armatures of the condenser is broken, and the condenser is tested for charge after the field is annulled, or the rotation stopped, or the condenser removed. It was argued that if the lines of induction moved with the magnets the condenser would receive charges which could be computed, and that it would remain uncharged in case the lines remained fixed and the magnets moved through them. However, this argument is now shown to be wrong and it is shown that on either hypothesis the condenser systems remain uncharged. Hence all attempts to solve the problem of unipolar induction by the measurement of charges or total intensities or emfs are vain. Nevertheless, the proper execution of the experiment described above was considered to be important, and the author gives in detail the execution and the results. The investigation leads conclusively to the result that the condenser system, when it remains at rest and the system producing the field rotates, receives not more than a minute fraction of the charge it would receive for the same relative motion if the system producing the field remained at rest. Within the limits of error of the experiments the fraction is zero.—*Physical Review*, November, 1912.

Singing Arc.—J. E. HOYT.—An account of an experimental investigation. Oscillograph curves are reproduced from photographs of varied electrical conditions of the singing arc. In the case of a single shunt the current in the arc is very nearly a sine curve and its frequency can be approximately determined from the simpler Duddell formula. The current through the arc is approximately that of the oscillating circuit superimposed upon the direct current. The effect of adding a second shunt is to cause the arc current to deviate largely from the sine form. The current is evidently considerably affected by varying conditions in the arc. The arc potential does not even approximately follow the variation of the sum of the potential differences of the condenser and inductance. The effect of introducing another shunt is to produce a phase shift in the condenser potential differences which may have the same frequency of discharge even if of different natural frequencies. An acoustic oscillograph was also constructed, and there are reproduced the first acoustic curves taken of the singing arc, and possibly the first reproductions of simultaneous electrical and acoustic oscillations. Ordinarily for a single shunt it is found that the sound, which is isochronous with the electrical oscillations, is of a rather simple form, the oscillograms showing only a single harmonic. In the case where the arc current is more complex, as when two shunts are used, the resulting sound curve is quite complex. In the latter case the arc responds to one or the other of the shunt-circuit frequencies, depending, for example, on the separation of the electrodes. There seems therefore to be a sort of tuning effect, regulated by some electrical changes produced by opening or closing the arc gap more or less.—*Physical Review*, November, 1912.

Absorption of Gases in Vacuum Tubes.—S. E. HILL.—An abstract of a paper read before the Physical Society in London giving an account of experiments carried out to determine whether the absorption of gases caused by passing a discharge for some time through vacuum tubes is the result of a chemical action or is a mere physical absorption. In order to eliminate all electrode complications, the electrodeless discharge was used throughout. The bulbs examined were of soda glass, lead glass, Bohemia glass and Jena glass. The absorptions were noted at different pressures and curves plotted. Continued passage of a discharge causes a "saturation" effect in all the glasses. After two months not one of the bulbs had recovered any of its absorptive power. If the action is chemical, it is natural to expect various oxidation products to have been formed. Testing these bulbs with hydrogen one would expect a large initial absorption tending to reduce these products. This was found to be the case for all the bulbs, the first reading for the soda glass giving 95 per cent absorption of hydrogen. After reducing the oxidation products one would expect a reabsorption of oxygen under the discharge. This was also found to be the case. The conclusion is that the disappearance is not due to physical absorption but to definite chemical action.—London *Electrician*, Nov. 8, 1912; a longer account of the paper appears in London *Electrician*, Nov 15, 1912.

Magnetic Flux.—F. EMDE.—The induced emf depends on the rate of change of magnetic flux, and the latter is accurately defined as a surface integral with the current-conducting wire as boundary. The conception of this surface is simple for a single loop, but for a long solenoid the conception of the surface offers some difficulties to a beginner. The author has devised a model for illustrating this surface. It is not a screw surface.—*Elek. u. Masch* (Vienna), Nov. 24, 1912.

Units, Measurements and Instruments.

Use of Iron in Electric Measuring Instruments.—DOLIVO-DOBROWOLSKY.—A note on a paper read before the Berlin Electrical Society. The author thinks that many of the commercial instruments now on the market are too sensitive in their mechanical construction so that their accuracy is impaired by rough handling. The reason is to be found in the tendency to make the movable system as light as possible, which means the application of weak forces. The author favors, on the contrary, strong forces to permit a robust construction of the instruments. For this purpose he uses a magnetic circuit mainly of iron. The detrimental effect of remanence and hysteresis losses is reduced by using an air-gap in the magnetic circuit, by using a special steel alloy, and by making the magnetic circuit short. The author exhibited wattmeters built by the Allgemeine Elektricitäts Gesellschaft according to this principle and called "ferrodynamic" instruments.—*Elek. Zeit.*, Nov. 21, 1912.

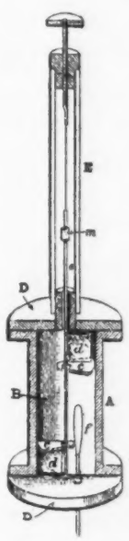


Fig. 5—Radiometer.

Radiometer.—F. W. JORDAN.—An illustrated paper read before the London Physical Society on an improved Joule radiometer designed to show the existence of the Peltier and Thomson effects (Fig. 5). A brass tube *A* was divided longitudinally into two compartments by a copper plate *B*. Two rectangular gaps were cut in diagonally opposite corners of the partition and two sector-shaped disks of copper *c c* were soldered to the edges of the gaps to form the horizontal sides of the channels for the current of air between the compartments. The partition *B* and the disks *c c* were soldered to the inner surface of the brass tube *A*. Two light mica vanes *d d* were fixed with a little shellac to a fine glass stem *e*. A small silvered-glass mirror *m* was attached to the glass stem *e*, and the whole system was suspended by a quartz fiber. The flanged ends of the brass tube *A* and the brass cover plates *D D* were ground plane and screwed together tightly. The glass tube *e* carrying the torsion head was fitted over a short brass tube fixed

centrally to the upper cover plate. The motion of the vanes was limited by stops to about 20 deg. The air in the interior of the apparatus was thus practically sealed from communication with the atmosphere and shielded from stray heat by the brass inclosure. The apparatus was fitted inside a concentric brass tube, and the whole was mounted on a leveling stand. The ends of a short length of eureka resistance wire *f* were soldered to two leads of copper wire. The insulated leads were fastened together and to the inside of a narrow glass tube with paraffine wax. The glass tube was passed through a circular aperture in the lower cover plate and sealed. A pair of dummy leads were similarily mounted in the other compartment to compensate any gain or loss of heat along the leads to the resistance loop. The deflections produced by measured currents through the resistance loop were very nearly proportional to the squares of the currents. A deflection of 122 mm on a scale at a distance of a meter from the mirror was produced by a current of 4.75 milliamperes through the resistance of 10.5 ohms. This gave a sensibility of 0.52 mm per microwatt. Alternating currents producing more than the full scale deflection could be conveniently and accurately measured by the compensation methods of H. L. Callendar and K. Angstrom. In Callendar's method the heat from the heater would be absorbed by the current through a thermo-junction in the same compartment. In Angstrom's method the heat would be balanced by the heat from a similar resistance in the other compartment. A calibration with direct currents would be necessary in every case to measure alternating currents.—London *Elec. Review*, Nov. 15, 1912.

Telegraphy, Telephony and Signals.

Conference of Time.—An account of the proceedings at the International Conference of Time (de l'Heure) held in October in Paris with reference to the creation of an international commission of time and an international bureau, the transmission and reception of time signals and various problems of wave transmission in general.—*La Revue Elec.*, Nov. 22, 1912.

Telephone Disturbances from Single-Phase Railways.—F. Marguerre.—An article illustrated by numerous diagrams on telephone disturbances caused by the single-phase railway line of the Rjukanfos power system in Norway. The disturbances were found to be produced mainly by the higher harmonics caused by the slots of the single-phase generators. These disturbances become greater the higher the wattless load. This is explained with the aid of oscilligrams and theoretical considerations. Since it was impossible to change the pole-shoe construction it was decided to provide the generators with a resonance circuit consisting of capacity and induction and connected to the terminals of the machines. The object of this resonance circuit is to short-circuit the machine for about 550 cycles per second so that its voltage curve contains no longer any component of this frequency. This remedy has been found to improve the conditions considerably.—*Elek. Zeit.*, Nov. 21, 1912.

Automatic Telephone Exchange.—G. H. Green.—A conclusion of his illustrated article on recent developments in automatic exchange telephone systems. In the present instalment the author describes in detail the two-wire Strowger system and refers to some interesting details in the Epsom exchange, which was the first public automatic exchange opened in Great Britain, and the recent General Post Office automatic exchange.—London *Electrician*, Nov. 22, 1912.

Wireless Telegraphy.—P. Boudier.—For tuning wireless telegraph transmitters a resonance condition is produced between the circuit charging the capacity and the frequency of the current supplied to the capacity. Two methods of calculating the resonance condition are described. The first assumes a transformer without stray flux for supplying energy to the capacity. This method is not applicable to transformers with an open circuit or to transformers which have different cores for the primary and secondary windings. The author has, therefore, devised a second method which is more general. It requires a no-load test, the measurement of the primary current at no-load and of the primary and secondary currents at short-circuit. The author gives an example showing the advantages of this second method.—*La Lumière Elec.*, Nov. 16, 1912.

Miscellaneous.

Presidential Address.—William Duddell.—His presidential address to the (British) Institution of Electrical Engineers. The author deplores the tendency of late years to limit more and more the papers read before the institution to one class of subject dealing with generation, distribution and the cost of electrical energy, and in many cases dealing only with these as large general questions. There are very many other applications of electricity which give work to many men and which employ much plant and apparatus. The author reviews various subjects which might be discussed in papers, especially recent progress in telegraphy and telephony, electrochemistry and electrometallurgy, household apparatus and subjects from the borderland of sciences, like electricity and chemistry, electricity and sound, and electricity and radiation.—London *Electrician*, Nov. 22, 1912.

Book Reviews

Ubungsaufgaben aus der Gleich und Wechselstromtechnik. By Fritz Hoppe. Leipzig: J. A. Barth. 224 pages, 158 illus. Price, 7.60 marks.

A carefully prepared short textbook on the elements of direct-current and alternating-current circuits, with numerous problems and examples. The book is divided into four chapters dealing respectively with the following subjects: The general elements of electrotechnics, alternating-current principles, measuring instruments, and measurements. An appendix gives a detailed description of the author's electrotechnical laboratory. The descriptions are clear and simple, and the mathematical work is of a practical and arithmetical nature. The work will commend itself to students of electrical engineering acquainted with the German language and studying at home.

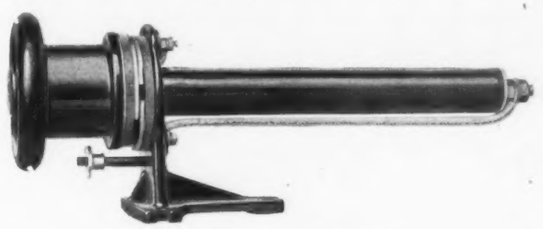
Travaux du Laboratoire Central d'Électricité. Paris: Gauthier-Villars. Part I (1884-1905), 514 pages, numerous illustrations; Part II (1904-1911), 483 pages, illus.

Two very valuable volumes of much technical and historical significance. They contain in order of date the principal reports and published tests of the Central Laboratory of Paris between the years 1884 and 1911. They represent, therefore, the results of more than a quarter of a century of laboratory work. The researches cover a great variety of subjects, from the testing of linemen's gloves to the theory of the singing arc. A considerable part of the work, however, concerns the direction of electric lamps and illumination. It would be well indeed if each and all of the electrical laboratories of the world would build up and collate their researches in such a manner as that shown in these volumes. In this way it would be possible to collect into a relatively small compass a considerable share of the electrotechnical work in each nation, because it is the national laboratories that naturally lead the way and set the example. The books show very clearly the remarkable mental aptitude of the French nation in clear conception, orderly arrangement and logical deduction. The work has been assembled with much care. The list of subjects appears in each volume at the end. It would be helpful if an index of subjects had been furnished in addition.

New Apparatus and Appliances

SMALL CONTROLLING RHEOSTAT.

The Allen-Bradley Company, of Milwaukee, has placed upon the market a new line of small regulating rheostats. These rheostats may be used for a great variety of purposes, such as speed regulators, field rheostats, laboratory rheostats, battery chargers, meter testers, lamp dimmers,



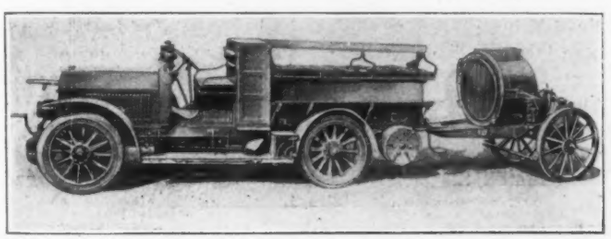
Small Controlling Rheostat.

medical and dental work, etc. They are of the graphite compression type and are made in two types, which are alike except that one is provided with a switch which short-circuits the resistor when the resistance has been reduced to the minimum. Neither type is arranged to open the circuit at any time.

The resistance is varied by turning the hand-wheel, and any intermediate value can be obtained between the minimum and maximum. The rheostats are furnished with practically any maximum or minimum resistance, and the range through which the resistance of each rheostat may be changed by turning the hand-wheel is in about the ratio of one to one hundred.

GUN-CARRIAGE-TYPE SEARCH-LANTERN.

As a result of the co-operation of the military officers and engineers of the Austrian government with the electrical manufacturing concern of Kolben & Company, in Prague, a search-lantern is being manufactured by that company which it is claimed has many advantages over the search-lanterns formerly used in connection with military maneuvers. The search-lantern mounted on its gun-carriage truck, together with a 60-hp automobile capable of carrying ten men and hauling the lamp at a speed of 25 miles per hour, forms a unit search-lantern battery capable of traversing very rough country and gaining vantage points quickly which would otherwise be difficult of access to a party in charge of a large lamp. The body of this gun-

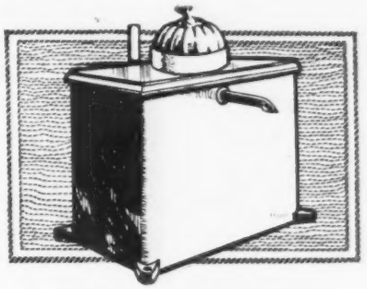


Gun-Carriage-Type Search Lantern.

carriage-type search-lantern is constructed of aluminum plates strengthened with stout magnalium rings, making it light but durable. The lamp is equipped with hand-wheels engaging worm and gear appliances for turning it in any direction or elevating it to any angle. One man can operate these gears even on a 48-in. lantern. When the lantern is in transport it is lowered to the position shown in the illustration and covered with a heavy leather hood to keep out the dust, but in the operating position the height of the optical focus is 90 in. above the ground line, giving ample clearance over small objects in the immediate vicinity. The principal parts of the lamp and carriage are so constructed that in case of emergency the whole affair may be taken down, transported by hand and reassembled in a new position within a short time and without the attention of an expert operator. The automobile carries all the accessories that are needed for operating the lamp, such as flexible wire cables, a generator supplying energy at an emf which can be varied from 63 volts to 80 volts, depending on the distance of the objective, reels for the cables, and other appliances. The total weight of a 46-in. search-lantern and carriage is 2050 lb. When in readiness for transportation it stands 118 in. in length, 59 in. wide and 76 in. high.

ELECTRIC WATER HEATER.

The Foster Engineering Company, Ltd., Wimbledon, London, has devised a new type of water heater, particularly suited for the bathroom. It is made in two sizes, one containing enough water for an ordinary hand basin, and the

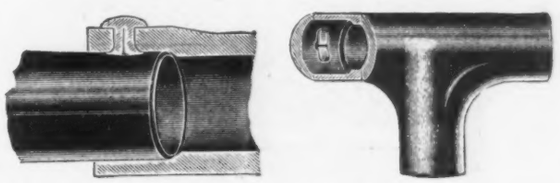


Electric Water Heater.

larger one of sufficient size for furnishing water for a bath. In the smaller size the temperature of two pints of water can be raised from 55 deg. to 110 deg. Fahr. in one minute. The cost of changing the temperature of a gallon of water from 55 deg. to 110 deg. Fahr. is stated to be 2 cents at a cost for energy of 10 cents per kw-hr.

GRIP FOR CONDUIT JOINTS.

The conduit grip illustrated herewith is notable for its simplicity and ease of application. A hole is bored near

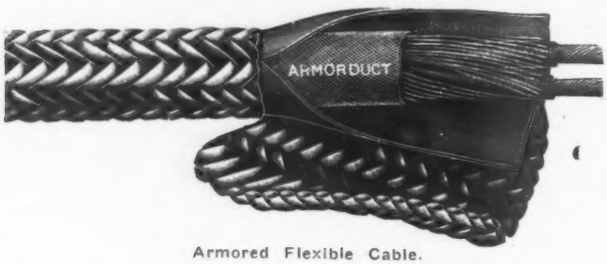


Sections of Conduit Joints.

the end of the conduit and a bifurcated or spreading rivet is hammered in. In spreading out, the rivet removes some of the paint or enamel on the tube, thus bringing about metallic continuity. If for any purpose it be desired to remove the rivets, special pliers for this purpose are employed. This conduit joint is made by the Electrical Conduits, Ltd., 18 Bennett's Hill, Birmingham, England.

ARMORED FLEXIBLE CABLE.

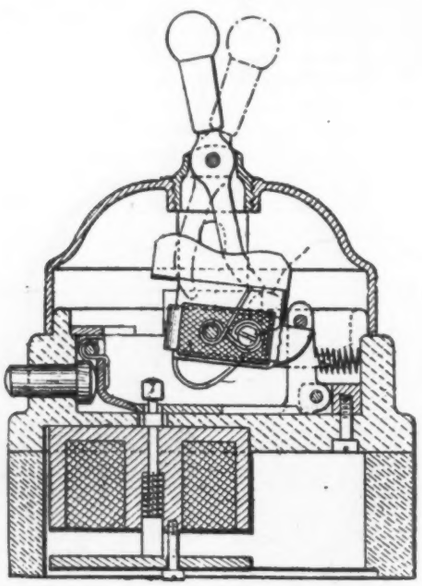
A flexible cable of particularly neat appearance, which makes it suitable for interior use, has been brought out by the Armourduct Manufacturing Company, Ltd., London. Besides its great flexibility, it is said to possess extraordinary mechanical strength. The illustration shows the construction of the cable. The conductors are stranded together, made circular with jute, covered with rubber-proofed tape and a sheathing of vulcanized rubber, and finally with a patented rubber cord braid. This armoring is said to be fully as strong as any metallic armoring and on account of its resiliency to be less susceptible to mechanical damage.



Armored Flexible Cable.

AUTOMATIC TUMBLER CIRCUIT-BREAKER.

There has recently been put upon the market an automatic tumbler switch, which is being manufactured by the C. W. Denny Company, of London, England, and which is claimed to be the smallest circuit-breaker now in existence. The illustration given herewith shows the type of switch which has been designed with the object of providing an automatic circuit-breaker for lines operating on light loads. This particular switch is intended for operation on circuits carrying not over 5 amp and for emfs up to 500 volts. These switches are intended to replace to a large extent the ordinary small porcelain bridge fuses and tubular fuses now in use on small lighting and power circuits and thus to obviate the present trouble and inconvenience caused in replacing blown fuses. The switch is also well adapted for controlling lamps either from a distributing board, which may be fitted with double-pole automatic switches, or from separate points by means of single-pole switches. It is claimed that these switches are also suitable for service as limit switches on a flat-rate system and may be used as main house-service switches. The switch is actuated by means of a small electromagnet the winding of which is connected in series with the switch and the armature of which tilts the rocking lever and releases the switch blades. Since the operating lever is not in any way fixed to the switch blades it is said to be impossible to keep the switch closed on short-circuit.



Automatic Tumbler Circuit-Breaker.

ILLUMINATION OF THE LAWYERS' CLUB, NEW YORK.

By W. H. Spencer.

It is interesting to note the great improvement in the art of illumination and how beautiful effects are produced with a low consumption of energy and low cost of maintenance. This improvement is most evident in modern hotels, clubs, restaurants and cafés, where attractive and novel illuminating effects form one of the main features of distinction. Instead of the ordinary equipment of chandeliers and brackets with their monotonous arrangement from parlor to pantry, the main rooms, such as the entrance corridor, lounging room, dining room, banquet room, etc., receive individual consideration in the detail of construction to provide for a scientifically and artistically designed system of illumination that will blend with the general scheme of decoration.

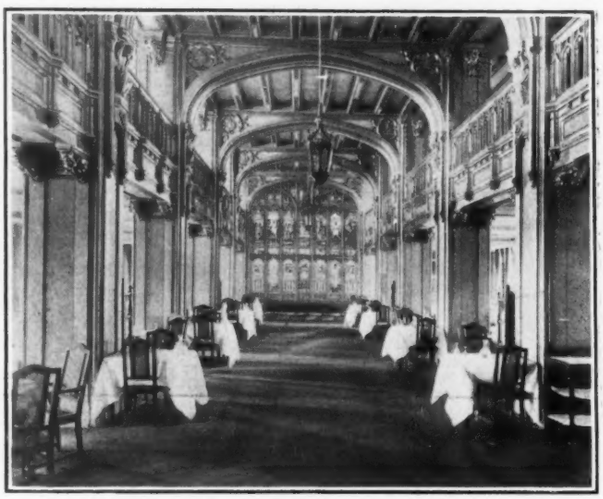


Fig. 1—Main Dining Room of Lawyers' Club.

In the illumination of the Lawyers' Club there are several features worthy of special attention. The main dining room is lighted by specially designed silvered, rippled-glass-lined Frink reflectors, equipped with so-called Linolite tungsten lamps. The light source is practically uniform and all spots and disagreeable shadows are eliminated. Through the aid of reflectors an evenly distributed light is obtained over the entire ceiling surface, whence it is diffused throughout the room. In the dining room with this system of illumination the physical as well as the artistic effect can be improved very materially by the utilization of shaded table lamps.

Special mention should be made of the illumination of the large stained-glass window at the end of the dining room. This window is 20 ft. wide by 22 ft. high and is designed to represent emblematically the law periods from the Mosaic period to the present time. It is admirably executed in masterfully chosen colors and beautifully illuminated by an indirect method without any loss in color value and without any glaring light spots. The light flux is so evenly distributed over the diffusing background that there is no ap-

parent variation in intensity on any part of the window. The diffusing surface is tinted with pigments that absorb most of the yellow and red rays of the lamps, thus producing a remarkably realistic daylight effect. Specially designed Frink reflectors are made use of in order to carry out this purpose.

In the reading room excellent results are obtained by the use of Frink semi-indirect reflecting chandeliers, which are

Fig. 2—Reading Room of Lawyers' Club, New York City.

well adapted for this purpose. About 80 per cent of the light is reflected to the ceiling. The reflector is so designed that the light is evenly distributed over the entire ceiling surface without a glaring light spot directly over the fixture. About 20 per cent of the light is diffused through an alabaster glass bowl. A person can read with absolute comfort and without eye fatigue while sitting in any position in any part of the room.

The lighting equipment was designed and executed by I. P. Frink, for whom the H. W. Johns-Manville Company, New York, is selling agent.

VIBRATING RECTIFIER FOR CHARGING THREE-CELL BATTERIES.

The rectifier illustrated herewith is intended for charging three-cell lead storage batteries, such as are used for

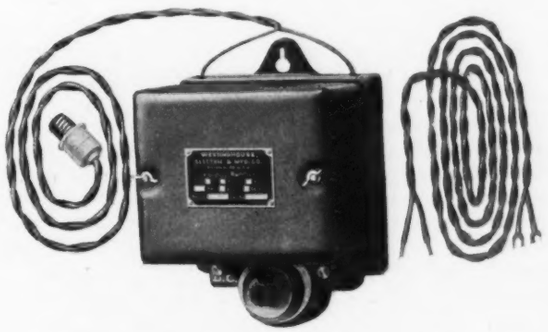


Fig. 1—Rectifier for Charging Batteries.

automobile or gas-engine ignition and for lighting automobiles from an alternating-current circuit. It is of particular benefit to the motor-car owner who has a three-cell battery equipment, as it enables him to charge his batteries at home, at small expense and with no trouble whatever, directly from his lighting circuit.

The apparatus consists essentially of a polarized relay acted upon by two alternating-current magnets so that it vibrates in synchronism with the alternations of the current, and arranged to reverse the connection of the circuit as the current reverses. The vibrating arm is magnetized by current from the direct-current side, so that one end is permanently north and the other end permanently south, depending on the way the battery is connected. The two stationary electromagnets are wound so that their upper ends are of the same polarity at each instant. When the alternating current is in one direction the upper poles of both stationary

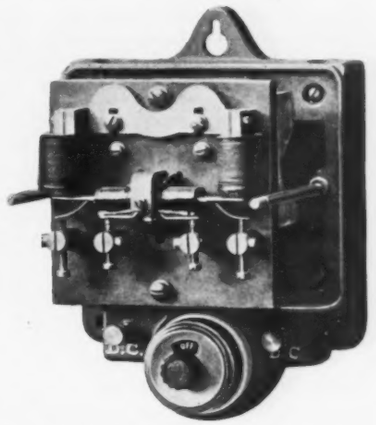


Fig. 2—Rectifier with Cover Removed.

magnets are north, attracting the south end of the vibrating arm and repelling the north end. This connects the alternating-current to the direct-current circuit in one direction. When the alternating current reverses, the pole of the alternating current magnets become south, attaching the north end of the vibrating arm and repelling the south end.

This reverses the connection of the alternating-current to the direct-current circuit, but as the direction of current has also reversed, the current is established in the direct-current circuit in the same direction as before. The reversal of the connections thus takes place every time the current reverses, so that the result is a pulsating direct current. A transformer reduces the voltage to the proper value.

The rectifier can be operated on any 60-cycle alternating-current circuit of 100 volts to 120 volts and will charge three cells at a rate of 6 amp to 8 amp.

The device is simple to operate and so compact that it can be conveniently carried along with the tool kit. It is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

GASOLINE-ELECTRIC LADDER TRUCK.

A new high-powered ladder truck of the gasoline-electric type has been added to the equipment of the Pittsfield (Mass.) fire department, as a result of a study of fire hazards in that city. The truck is one of the first of its kind to be installed in New England and is a 75-ft., four-wheel-drive aerial hook and ladder outfit. It is propelled by series motors geared to the individual wheels and has a wheelbase of 335 in. Energy is supplied by a direct-current generator driven by a gasoline engine, and the truck is capable of making a speed of 25 miles per hour on the level. The wheels are equipped with double 36-in. by 3.5-in. tires, and the wheels are all connected with the steering gear. The control is mounted on the steering wheel shaft. The truck proper was made by the American LaFrance Engine Company, of Elmira, N. Y., the motors and generators having been built by the General Electric Company, Schenectady, N. Y.

Industrial and Financial News

ELECTRICAL TRADE CONDITIONS—III.

THE final instalment of replies which we have received from electrical manufacturers and others in response to circular letters asking for data on conditions in the electrical manufacturing and allied fields in 1912 is given below. Judging from all of the replies received, the first set of which appeared on Nov. 30 and the second on Dec. 7, the year has been one of distinct progress in the electrical manufacturing industry. The present set of replies shows in most instances, as did the preceding groups, that there has been a material increase in the volume of business done this year as compared with that in 1911. In many cases, however, the percentage of profits has not increased in proportion to this gain. Nearly all the replies are optimistic as to the prospects for next year. Reports of extensions and additions to manufacturing facilities in order to meet the large business expected in 1913 are very numerous. In view of the excellent aspects of the general trade situation and the continually broadening application of electrical energy in the industrial field alone, the many expressions of confidence on the part of electrical manufacturers in the outlook in their line for next year seem to be decidedly well founded.

LINE MATERIAL: (a) An Eastern Manufacturer.—Our business shows increased volume this year as compared with last year, but as a rule this was taken at lower prices. We attribute the increase in volume to the expansion of the country and the decreased prices to the tendency to withhold purchasing until after election and to buy only at known bargains. There will probably be good business at better prices next year, but this will depend upon how soon and in what manner the tariff and other matters of fundamental importance to the business of the country are determined by Congress and the Supreme Court. We think that the question is largely up to Congress and our next President. The Democrats are offered the opportunity of making possible an era of great prosperity. How they will meet conditions is being more or less awaited by the business world. We think that the greatest drawback to expansion is the policy of buying only from hand to mouth, or, in other words, the fear to go ahead extensively, and also the apparent fear that present prices may be much higher than those obtainable next year. We will manufacture and push the sale of new products required by the industry next year, if the present volume of business is maintained.

(b) From the Same Section.—Our business for 1912 up to date is approximately 25 per cent greater than that for the same period of 1911, with profits on a much better basis than in 1911. We attribute our increase to the absolute necessity for electric railways to purchase more freely in order to maintain their equipment, as they have lived from hand to mouth since 1908. We believe that 1913 is going to be a very good year if there is not too much tariff agitation and the world financing incident to possible war expenses does not limit the money supply for public utilities. We think the greatest drawbacks in our field are the cumulative effect of over-building in the electric railway line for years past and, temporarily, the restrictions imposed by public service commisions. This latter condition we believe to be ultimately for the great good of electric railways and those engaged in manufacturing materials used in that line of business.

INSULATED WIRE AND CABLE: (a) An Eastern Manufacturer.—The volume of our business this year was larger than in 1911, owing to the increased demand which is general throughout the country. The basic conditions for a good volume of business for 1913 are excellent. Only the fear of radical tariff changes will upset reasonable expectations. The Sherman law demands should be clarified for business honestly capitalized and conducted with absolutely no intent toward monopoly or monopolistic control. Restraint of competition should not *per se* be considered restraint of trade. Manufacturers should be free to resort to informal discussion with one another on market, price and trade conditions with a view to avoiding excessive competition and trade warfare. All this is rational and ethical and represents simply the idea of conservatism and co-operation in the best sense applied to business. It is right for manufacturers engaged in interstate trade to try to maintain the value of honestly invested capital, while it is wrong to use any means to acquire or attempt monopolistic control either of any industry or the prices that govern in such industry. We do not contemplate extensions to our works other than those of minor cost and importance to develop more economical manufacture.

(b) From the Same Section.—The volume of our business in the latter part of 1912 has exceeded somewhat, we believe, that entered in the same period last year. The first part of the year was about the same. We attribute the increase to more sound conditions and to larger buying on account of reduction in stocks on hand. Our opinion on the price and business outlook is a very optimistic one.

(c) Detroit Insulated Wire Company.—As regards 1912 results, the volume of our business has increased materially this year, but profits have not been as large as would be desirable and equitable. We attribute the increased volume to general business improvement, and the low profits to abnormally close prices caused by lack of knowledge of actual costs on the part of a number of manufacturers. We expect a fair increase in volume and better prices in 1913 than the average of 1912. We are expanding as fast as capital, time, men and brains available make it possible. Settle the matter of tariff and the country's business should continue to expand. We are just completing enlargements to our plant that give us a capacity about two and one-half times our capacity of six months ago. This increase has placed us in a position to manufacture any and all sizes of rubber-covered wire and cable.

INSULATING MACHINERY: New England Butt Company.—Up to Nov. 1 the volume of our business for 1912 was practically the same as it was in 1911 and 1910 for the same period, with a slight increase over 1911 appearing about Nov. 1. We attribute this to better feeling generally throughout the country and to favorable crop reports. Our opinion regarding the outlook is that business will be largely improved in 1913. The present situation in many lines shows improvement. Present prices will be maintained in our general line of machinery. Changes may occur in our foundry department, depending upon the cost of iron, which has advanced. We are not considering any condition that will operate as a drawback in our field. Competition may arise and our improved methods will enable us to meet it. We are not considering any extension to our plant. We have adopted scientific management to increase our facilities, improve our product and create better opportunities for our employees.

HIGH-TENSION EQUIPMENT: Delta Star Electric Company.—Business conditions have been very satisfactory as compared with those in 1911, which can be attributed to the natural increase in demand for high-tension equipment. The development in high-tension protective apparatus during the past year has been along the lines of weatherproof equipment for use in connection with high-tension outdoor substations. Early in 1913 a new line of automatic and non-automatic air-break high-tension switches will be announced, their special application being in the protection of outdoor substations. The established line of S. & C. high-tension chemical fuses is being extended as new conditions arise, and particular attention is being paid to the weatherproof forms up to and including 66,000 volts.

ONE OF THE LARGEST MANUFACTURERS OF ELECTRICAL EQUIPMENT.—This year's business shows a 10 per cent increase over that of 1911. This has been due to generally prosperous conditions. We are not contemplating enlargements.

MECHANICAL CONNECTORS AND TERMINALS: Dossert & Company.—Our 1912 business has been the largest in the history of our company, and an increase of 35 per cent over 1911 is already assured. We attribute the increase to the general expansion and development that have taken place in the production, distribution and utilization of electrical energy, conditions which have been accelerated by the co-operative movements that have been participated in so generally by central-station, manufacturing, jobbing and contracting interests. We anticipate continued growth and expansion in our particular field, owing to the steadily increasing demand for our products. We are now engaged in the work of doubling the capacity of our manufacturing plant and are planning further additions of men and machinery early in 1913. The fact that the 1913 automobile will be practically a moving electric-power plant has caused considerable enlargement of the field for our devices.

ARC LAMP AND HEATER CORD: (a) From an Eastern Manufacturer.—Our business in arc lamp cord has been a little larger this year than in 1911, which we attribute more to the proved quality of our goods for the special purposes required than to any definite improvement in general business. We do not see any likelihood of a material change in the situation for 1913, unless too much of a boom is promoted now, resulting in depression later on. We do not contemplate any extension of our works, except those necessary for improvement in processes, as production in our line has been increased in the past few years faster than demand.

(b) From the Same Section.—Both volume of business and profits increased this year, owing to good crops and to general increase in the wealth of the country. Conservatively speaking, we think the outlook for next year is good.

ELECTRICAL SUPPLIES: Manhattan Electrical Supply Company.—We have had a substantial increase in business and profits in 1912 over 1911. We attribute this increase to the prosperous condition of business in general throughout the country. We believe the outlook for 1913 to be excellent and that prices will be fully as good as in 1912. We do not know of any particular drawback to expansion in our field. We have recently increased our capital stock from $750,000 to $5,000,000, are just completing a new addition to our main factory by erecting a six-story building, 75 ft. by 100 ft., and have also acquired a plot of real estate in another section of Jersey City on which we are to erect a carbon plant. In July of this year we opened a new branch in St. Louis and are contemplating opening others.

CONSTRUCTION TOOLS: Our business has increased in volume, and profits have increased with volume, but net profits are perhaps less, owing to higher prices for material, which additional cost we have thus far absorbed. We attribute the improvement to general activity in the electrical industry. Prices will probably go higher unless there is a lull in the demand. We prefer to be conservative, however, until the reaction due to the change of administration has had time to reveal indications. We have outgrown our present capacity and are planning a new factory to combine our two separate plants. Building will probably begin in the spring.

CHOKE COILS, FUSES, LIGHTNING ARRESTERS, SWITCHES: Railway & Industrial Engineering Company.—Our 1912 business was three times that of 1911. This was due to our extensive campaign, including widespread advertising. From the present standpoint, the outlook for next year is good. We expect to have all the business we can handle. The greatest drawback is ultra-conservatism on the part of some of the older companies. We recommend more complete testing plants for operating companies.

CONDUIT RODS: This year's business compares very favorably with that in 1911. Orders for the year have been double those in any previous year since 1907 but have not been for nearly as large amounts as in the past. As regards the future, there is work to be done, but when it will be commenced is a question. We are continually increasing the size of our plant to obtain increased output.

CARBON BRUSHES: This year's business shows an increase of 100 per cent over that in 1911. We attribute this to the quality of our product. We think the outlook is good.

SWITCHES, SWITCHBOARDS AND PANELBOARDS: During the first three months of this year business was very slow with us, but it improved later on, so that in the last six months and to date it has been ahead of last year's showing. As regards the outlook, we expect that the cost of raw material will remain about the same as it is at present. We expect a great increase in business in electrical lines next year. We have added 12,000 sq. ft. of floor space to our factory in the last two years, are employing more help than heretofore, and, in general, have increased our business about 50 per cent. We expect to add more space in the coming year.

TESTING LABORATORIES: Business with us in 1912 and 1911 has been about the same, showing a tendency to increase during the last quarter in 1912. We are bullish on the outlook. The greatest drawback to expansion in our line is careless purchasing. Purchasing agents know less and care less about quality than about price and are influenced more by glib salesmen than by knowledge obtained by tests and inspections. The remedy is to educate the purchaser in the net advantages of inspections and tests by independent and competent authorities.

WIRING SPECIALTIES: Pass & Seymour, Inc.—Our 1912 business shows a very heavy increase over that of 1911. The profits will probably run smaller on the volume than last year. We attribute the increase in volume to the general betterment of the business situation. As regards the outlook, business should be good if changes in the tariff are not too radical. Prices will probably have an upward tendency. We shall make the usual additions and extensions to our line, but do not contemplate any building operations of note.

FIXTURES, SOCKETS AND RECEPTACLES: Our 1912 business shows an increase in volume of about 30 per cent. The percentage of profit has been somewhat lower on account of the increase in the cost of material and labor. We attribute the increase in business to generally improved business conditions and to the extension of our line, particularly in the direction of industrial lighting. Judging from the experience of the past few months, the normal trend of business should be upward for some time to come.

PORCELAIN INSULATORS AND SPECIALTIES: Our business this year was 15 per cent more in volume than in 1911 and profits have been somewhat better. We attribute this to the large building and construction operations that were carried on during the year. We think, as regards the business outlook, that 1913 will be a considerably better year than was 1912. There are no drawbacks to expansion in our field as far as we can see. We are not making any extensions at the present time.

GLASS INSULATORS: The volume of our business this year was about the same as it was last year, but our profits were less. This has been due to the fact that there has been an unwarranted decrease in prices on the part of competitors with no compensating decrease in the cost of production. We are pessimistic as to prices and optimistic as to volume as regards the outlook for 1913. We are not increasing our manufacturing facilities at present.

INSULATED TEST CLIPS: R. S. Mueller & Company.—Both volume of business and profits show a very material increase over returns in 1911. This has been due mostly to the general increase in business activity, but also in a large measure to the growth of the electrical industry as a whole. We look for continual improvement in prices and volume of business at least equal to that of the last half of 1912.

POWER-STATION ACCESSORIES: This year's business was much better than that in 1911, which has been due to the buying by steam railroad companies. We think the outlook is good. The greatest drawback is in the Democratic party and the tariff. We should expand, but will do nothing until the policy at Washington becomes more clearly defined.

REFLECTORS: Holophane Works of General Electric Company.—(No answers to Questions 1, 2 and 4.) The outlook for business in 1913 is excellent; that for prices is dubious. We are building a new glass factory and a new steel reflector factory at Cleveland, Ohio.

INSULATING JOINTS, SMALL RESISTANCE UNITS: Wirt Electric Specialty Company.—Our 1912 business has been much larger than that of 1911. We attribute this to the natural growth of incandescent lighting, partly due to the tungsten lamp. We expect a larger business in 1913 and also to advance our prices owing to increase in cost of labor and material. The greatest drawback in our field is the great tendency on the part of contractors to use the cheapest possible material. The remedy lies in extension of the underwriters' local inspection and label service.

WOOD PRESERVATION: Business with us was very much better this year than it was last year. This has been due to our personal efforts and solicitation. We think the outlook is very favorable. The greatest drawback in our line is that the employees in the different industries do not want to have the trouble of putting the preserver on the timber.

SPRINGS: Dunbar Brothers Company.—Our 1912 business shows a gain of about 20 per cent over that of 1911. We attribute this to greater steadiness in the financial markets. We look for continued advance next year and for possible increase in prices. Large extensions to our plant are nearly completed and others are contemplated.

WOODEN POLES: Our business in 1912 has been about the same as that in 1911. We think the outlook is good.

INDUSTRIAL AND FINANCIAL NOTES.

Kentucky Utilities Company Enlarging Its Holdings.—A trust bond in the sum of $5,000,000, in favor of the Illinois Trust and Savings Bank, of Chicago, has been executed by the Kentucky Utilities Company at Elizabethtown, Ky. This corporation recently acquired a number of Kentucky utility properties and is planning extensive development of these, seeking to enter other cities with its lines and proposing ultimately to operate electric railways as well as central stations. The mortgage which has been executed covers the electric light, power and water plants at Mount Sterling, Versailles, Shelbyville, Somerset, Winchester and Elizabethtown. The company plans to secure franchises for electric service in Pleasureville, Eminence and New Castle in the near future. In connection with these plans, it is understood, the Kentucky Utilities will erect and equip a million-dollar power plant at Winchester, from which it will serve a wide territory in that section of the State. Winchester, Mount Sterling, Versailles, Somerset, Shelbyville and other cities will be supplied with energy from this plant, it is stated, and interurban railways will be constructed between these and other points.

Flaming Arcs for Armories and Theaters.—The H. M. Hirschberg Company, agent for Plania carbons and Siemens flaming-arc lamps, has recently received a number of orders for lamps to be used for armory lighting and for outdoor theater illumination in New York and Brooklyn. One order calls for forty-two flaming arcs of the Alba type for the armory of the Twenty-second Regiment, N. G. N. Y., and another is for thirty-eight of the converging type for the armory of the Seventh Regiment. Fifty-three lamps of the forty-hour type have been ordered for the Fox Audubon Theater, New York. This building occupies the block bounded by Broadway, 165th and 166th Streets and St. Nicholas Avenue, and the entire block will be illuminated by these lamps. Eighteen lamps have been sold for use at two other theaters in New York and Brooklyn. Samples of the new Siemens 125-hour flaming-arc lamp were received recently by the Hirschberg company.

Central-Station Service for Drop-Forging Plant.—The Union Drop Forge Company, of Chicago, is concentrating its manufacturing operations at its large North Works at 1746 North Forty-fourth Avenue. In doing so it has entered into a contract to buy electrical energy for the entire operation of its factory from the Commonwealth Edison Company. When the operations now carried on at the West Indiana Street plant are fully established at North Works, the latter will require about 1000 hp in electric motors. Alternating-current motors arranged for both group and individual drive are to be used. The present energy requirements of the company are supplied by the Sanitary District of Chicago and from isolated steam plants.

American Telephone & Telegraph Subsidiaries Absorbed.—The Southwestern Telegraph & Telephone Company, which, as noted last week, increased its capital to $40,000,000, will take over the properties of the Bell Telephone Company of Missouri, the Southwestern Telephone Company and the Missouri & Kansas Telephone Company, all of which are subsidiaries of the American Telephone & Telegraph Company. A meeting of the board of directors of the Southwestern company will be held on Dec. 17 to elect as officers the present officials of the Bell Telephone Company of Missouri. The taking over of the three concerns is for the purpose of simplifying operation of Bell Telephone companies in the Southwest by bringing them under one management, with headquarters in St. Louis.

Call for Third Allis-Chalmers Assessment.—The reorganization committee of the Allis-Chalmers Company has called for a third instalment of the assessment on the preferred and common stocks of that company under the reorganization plan. This instalment calls for $6 per share on the preferred and $3 per share, payable Jan. 15, on the common. Up to Dec. 4, the following amounts of outstanding bonds and stock of the company had been deposited under the plan: First mortgage 5 per cent bonds, $10,458,000, or 93 per cent; 7 per cent cumulative preferred stock, $14,146,500, or 88 per cent, and common stock, $17,215,600, or 86 per cent. The court has ordered that the foreclosure sale of the Allis-Chalmers properties take place on Feb. 3.

A New California Company.—The California Railway & Power Company has been organized in Delaware to acquire all of the outstanding capital stock of the United Railroads of San Francisco, the San Francisco Electric Railway, the Sierra & San Francisco Power Company and the Coast Valley Gas & Electric Company. The new concern has an authorized capital of $50,000,000 common stock, $10,000,000 7 per cent cumulative preferred and $5,000,000 prior preference 7 per cent preferred stock. The common, of which $40,000,000 has been issued, and the preferred, of which $6,874,000 has been issued, is owned by the United Railways Investment Company.

Utilities Improvement Offering Taken in London.—An offering of $5,000,000 6 per cent preferred stock of the Utilities Improvement Company made in London through Lloyds' Bank, Ltd., was taken at once. The stock was offered at £17 14s., or $86, a share. The company is under the management of Henry L. Doherty & Company. A list of the properties which it controls appeared in these columns Oct. 19.

New York Edison's Earnings.—It is believed that the balance which the New York Edison Company will have available for dividends at the end of the current calendar year will be the largest in the history of the company. Estimates place this at 19 per cent on the $50,400,400 stock outstanding, which compares with 17½ per cent in 1911, heretofore the record year.

San Joaquin Bond Issue Approved.—The California Utilities Commission has granted permission to the San Joaquin Light & Power Corporation to issue $925,000 of bonds. Of this, $320,000 of bonds are to be issued for the purpose of discharging indebtedness and the balance will be issued from time to time for the same purpose.

Southern Power Company to Build New Station.—Plans have been completed for the construction of a power station at Lookout Shoals on the Catawba River, about 12 miles from Statesville, N. C., and some 60 miles from Charlotte, for the Southern Power Company. About 16,000 hp is to be developed there.

Toledo Railways & Light Reorganization.—About 86 per cent of the bondholders and 70 per cent of the stockholders of the Toledo Railways & Light Company have assented to the plan of reorganization of the company by depositing their securities with the New York Trust Company, depositary.

Increases Its Capital Stock.—The Utah Power & Light Company has increased its capital stock from $1,000,000 to $40,000,000 for the purpose of merging public-utility companies in Utah, Idaho and Colorado, as noted in these columns Oct. 19.

Hydroelectric Developments on the Deerfield River, Mass.—Our attention has been called by the Power Construction Company to a misleading statement in our issue of Nov. 23, page 1116, to the effect that among the hydroelectric projects under construction by J. G. White & Company, Inc., was that of the New England Power Company, on the Deerfield River, near Shelburne Falls, Mass. The facts are that the Chace-Harriman, Baker-Ayling interests of Boston, which are largely interested in the Connecticut River Power Company, whose plant was built by J. G. White & Company, owned or controlled the necessary property and flowage rights on the Deerfield River for a series of hydroelectric developments there. J. G. White & Company's engineering department made the preliminary studies and reported on the feasibility of the project. In July, 1911, the Boston interests jointly with J. G. White & Company organized the Power Construction Company, to which was given the general contract for all engineering and construction of these hydroelectric developments, with necessary transmission lines, substations, etc. The ultimate scope of this work embraces some $15,000,000 worth of construction for the New England Power Company and its affiliated interests on the Deerfield River. J. G. White & Company, Inc., initially owned 45 per cent of the capital stock of the Power Construction Company, but in August, 1912, they sold their interest to the controlling interest in Boston. White & Company have from the beginning been the consulting engineers for the Power Construction Company, and still hold this relation. There has been an idea in some quarters that the Power Construction Company was a subsidiary or field organization of J. G. White & Company, this idea having originated apparently from the fact that a number of the staff of the Power Construction Company are old White & Company men, and because the relations between the two companies are very intimate and cordial.

Personnel of the Service Engineering Company., Inc.—Offices have been opened at 13-17 South Eighteenth Street, Philadelphia, by the Service Engineering Company, Inc., which has been formed with a capitalization of $10,000 by several men of broad experience in the manufacturing, engineering and traction fields to engage in a general electrical and mechanical engineering business. The activities of the new company will include the repairing, purchase and sale of motors, generators, etc., and the installation of isolated plants, switchboards, etc. Mr. Frank D. Miller, of the National Brake Company, Buffalo, N. Y., is president of the new concern, and Mr. John L. Gould, master mechanic of the Reading Traction Company, is vice-president. Mr. T. Edgar Kirk, construction engineer of the Electric Storage Battery Company, is secretary and treasurer of the company, and Mr. Harry Branson, formerly superintendent of rolling stock and equipment of the Philadelphia Rapid Transit Company, is its shop superintendent.

Illinois Traction Subsidiaries Increase Capital.—Notices of stock increases have been filed by subsidiaries of the Illinois Traction Company as follows: Urbana & Champaign Railway, Gas & Electric Company, from $500,000 to $750,000; Urbana Light, Heat & Power Company, from $100,000 to $150,000; Decatur Railway & Light Company, from $1,300,000 to $1,375,000; Peoria Railway Company, from $1,000,000 to $1,010,000, and Madison County Light & Power Company, from $100,000 to $135,000.

Applications to List on New York Exchange.—The General Electric Company has applied to the New York Stock Exchange to list $23,297,000 additional capital stock and $10,000,000 5 per cent debentures due 1952. The Cumberland Telephone & Telegraph Company has applied for the listing of $15,000,000 twenty-five year first and general mortgage 5 per cent bonds due 1937.

Southern Power Bonds.—A block of $1,000,000 first-mortgage 5 per cent gold bonds of the Southern Power Company has been purchased by Harris, Forbes & Company, Perry, Coffin & Burr and the National City Bank, who are offering the same to investors. Earnings of the company in the past year were over five times the annual bond interest charge.

United States Independent Telephone Receiver Discharged.—Following the filing of affidavits by all of the creditors that their claims had been satisfied, the receiver for the United States Independent Telephone Company, of Rochester, N. Y., has been discharged and the dissolution of the company and forfeiture of its charter have been ordered.

Shawinigan Water & Power Increases Its Dividend Rate.—A quarterly dividend of 1½ per cent on its stock, payable Jan. 20 to stock of record Jan. 7, has been declared by the Shawinigan Water & Power Company. This is an increase of one-quarter of 1 per cent in the quarterly rate and places the stock on an annual basis of 6 per cent.

Canadian Westinghouse Dividend.—The Canadian Westinghouse Company, Ltd., has declared the regular quarterly dividend of 1¾ per cent and a bonus of 2 per cent, payable Jan. 10 to stockholders of record Dec. 31.

Fort Dodge Light & Power Bonds Called.—All of the outstanding 5 per cent bonds of the Fort Dodge Light & Power Company have been called for payment at the Chicago Title & Trust Company on Feb. 1.

NOVEMBER STATEMENT OF COPPER PRODUCERS' ASSOCIATION.

The November statement of the Copper Producers' Association, issued Dec. 9, compares with the October statement as follows:

	—November, Pounds—		—October, Pounds—	
Stocks on hand in the United States on first of month		76,744,964		63,065,587
Production		134,695,440		145,405,453
		211,440,404		208,471,040
Domestic deliveries	69,369,795		84,104,734	
Export deliveries	55,906,550		47,621,342	
Total deliveries		125,276,345		131,726,076
Stocks on hand at end of month		86,164,059		76,744,964

NEW YORK METAL MARKET PRICES.

	—Dec. 3— Bid.	Asked.	—Dec. 10— Bid.	Asked
Copper:				
Standard, spot	17.10	.....	16.87½	.....
	£ s d		£ s d	
London, standard, spot	76 13 9		75 10 0	
Prime Lake	17.65 to 17.70		17.60 to 17.65	
Electrolytic	17.50 to 17.60		17.45 to 17.50	
Casting	17.35 to 17.40		17.25 to 17.35	
Copper wire, base	19.00		19.00	
Lead	4.35		4.35	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.40		7.37½	
Tin, spot	49.50 to 50.00		49.05	
Aluminum:				
Prompt delivery	26.25 to 26.75		26.00 to 26.50	
Future	26.00 to 26.50		25.75 to 26.25	

OLD METALS.

Heavy copper and wire	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.75	8.50
Lead, heavy	4.30	4.15
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN DECEMBER.

Total tons to	Dec. 4, 2,180	Dec. 11, 8,075

INDUSTRIAL SECURITIES

Security.	Capital Stock Listed.	DIVIDEND. Per Cent.	Period.	QUOTATION. Dec. 4.	Dec. 11
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	2⅜*	2*
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	8½*	6½
Amalgamated Copper	153,887,900	1	Q	82⅛	74⅞
American Tel. & Tel.	334,712,300	2	Q	142	137⅝
Crocker-Wheeler, c.	1,700,000	1¼	Q	85*	85*
Crocker-Wheeler, pf.	500,000	1¾	Q	105½*	105*
Electric Storage Battery, c.	16,074,425	.....	.....	54½	53¾
General Electric	77,726,700	2	Q	183½	179½
Mackay Cos., c.	41,380,400	1½	Q	85½*	84*
Mackay Cos., pf.	50,000,000	1	Q	68*	67½*
Western Union Tel.	79,943,400	¾	Q	77½	77½
Westinghouse, E. & M., c.	31,685,300	1	Q	80½	75½
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	123*	121

*Last price quoted.

Personal

Mr. Charles E. Warsaw has succeeded **Mr. F. W. Linebaugh** as manager and superintendent of the municipal electric-light plant at Ames, Ia.

Mr. S. L. Oliver has been appointed manager of the municipal electric-light plant at Mount Olive, N. C., in place of **Mr. T. Eldridge,** resigned.

Mr. A. R. Law has been appointed chief engineer of the Mutual Electric Light & Power Company of Alamosa, Col., in place of **Mr. E. J. Adams,** resigned.

Mr. D. R. Swing has been appointed general superintendent of the municipal water, gas and electric plant at Tallahassee, Fla., succeeding **Mr. C. H. Ellis.**

Mr. W. R. Maddex, formerly manager of the municipal plant at Linton, Ind., has resigned and accepted a similar position with the Bicknell (Ind.) Light & Power Company.

Mr. Frank E. Shepard, president of the Denver Engineering Works Company, addressed the Colorado Electric Club, Dec. 5, on the use of the slide-rule in engineering calculations.

Mr. C. H. Kerner, formerly chief engineer of the Elkins (W. Va.) Power Company, has been made chief electrician of the company, and **Mr. Ralph B. Fields** has been appointed chief engineer.

Mr. W. D. Weaver, formerly editor in chief of the *Electrical World* and now its consulting editor, who sailed for southern Europe on Oct. 7, has returned to his home in Charlottesville, Va.

Mr. B. J. Tremaine and **Mr. F. S. Terry,** managers of the National Quality Lamp Division of the General Electric Company, are both undergoing treatment at the Battle Creek (Mich.) Sanitarium.

Mr. John Charles Van Duyne has been appointed auditor of the Edison Electric Illuminating Company of Brooklyn. Mr. Van Duyne was formerly chief of the collection bureau of the New York Edison Company.

Mr. T. H. Mandell, city engineer of Lake Charles, La., has been appointed chief engineer of the Louisiana Power & Traction Company, which proposes to erect an electric railway from Lafayette to Lake Charles, La.

Mr. J. F. Roth, for many years connected with the Hartford (Conn.) Electric Light Company, was presented with a gold watch recently when he severed his connection with the company to engage in electrical contracting work.

Mr. Louis A. Ferguson, vice-president of the Commonwealth Edison Company, of Chicago, who was afflicted with a painful illness last May, returned to his desk on Dec. 9 and received the cordial greetings of his associates.

Mr. Anson Wood Burchard, assistant to the president of the General Electric Company, and Mrs. Theodore Hostetter were married in London, England, on Dec. 5. Mr. E. W. Rice, vice-president of the General Electric Company, acted as best man.

Mr. R. F. Trennert, chief electrician of the Union Tool Company, Torrance, Cal., and formerly electrician on the Los Angeles Aqueduct project at Newhall has resigned to take up work as electrical engineer with the Fairbank Morse Company at Los Angeles, Cal.

Mr. W. F. Ficklen, Jr., formerly sales engineer with the Crocker-Wheeler Company and who previous to that was connected with the Moody & Almon Company on central-station work in Vermont, has been appointed superintendent of the Staunton (Va.) Lighting Company.

Mr. Douglas Sprague, consulting engineer of New York City, has been commissioned by the municipal lighting committee of the Common Council of Binghamton, N. Y., to draw up plans and supervise the erection and operation of a municipal electric-light plant for that city.

Prof. Hylon T. Plumb, who, under leave of absence from Purdue University, has been serving as local engineer for the General Electric Company's Denver office, was recently transferred to the Salt Lake City office of the same company, with headquarters in the Newhouse Building.

Mr. James T. Hutchings, general manager of the Rochester Railway & Light Company, Rochester, N. Y., was a recent speaker before the Empire State Forest Products Association at Watertown, his subject being "The Hydraulic Development of the State Through Co-operation."

Mr. J. W. Lafferty, for many years superintendent of the construction department of the Edison Electric Illuminating Company of Brooklyn, has severed his connection with the company. For the present **Mr. L. D. Sharkey,** assistant superintendent, has been placed in charge of the department.

Mr. O. C. Hirtzel, who has been for sixteen years treasurer and general manager of the Eureka Company and its predecessor, the Eureka Tempered Copper Works, has resigned to become affiliated with the Westinghouse Electric & Manufacturing Company, with headquarters in Pittsburgh, Pa.

Mr. Samuel G. McMeen, president of the Columbus Railway & Light Company, Columbus, Ohio, is scheduled to deliver a series of lectures before the engineering classes of the Ohio State University. The first lecture, the subject of which was "Imagination as an Engineering Asset," was delivered on Dec. 13.

Mr. F. W. Harris, who has been with the Westinghouse Electric & Manufacturing Company as a designer of switches, fuses, circuit-breakers and arc lamps for many years, has severed his connections with the company and has opened an office in the Delta Building, Los Angeles, Cal. Mr. Harris is developing some special types of apparatus.

Mr. H. C. F. Poste, who for the past five and a half years has been electrical superintendent of the Massena (N. Y.) works of the Aluminum Company of America, has resigned to accept a position with the Canadian Light & Power Company at St. Timothée, Quebec. Mr. Poste will have charge of the power house and of all work on the Beauharnois Canal.

Mr. George E. A. Fairley, a local consulting engineer of Baltimore, Md., has been appointed assistant to Chief Engineer Raleigh C. Thomas, of the Electrical Commission of the city of Baltimore. Mr. Fairley succeeds **Mr. George B. Roberts,** who resigned several months ago, and will assist in the preparation of plans for the extension to the municipal conduit system.

Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, who sailed for Europe on Sept. 18 to visit the various foreign properties in which the company is interested, returned to New York on Dec. 3 greatly encouraged with the outlook of the foreign Westinghouse companies. He was particularly impressed with the Italian and Austrian properties.

Mr. Herbert Lutz, chief inspector of gas and electricity at Hamilton, Ont., for the Internal Revenue Department of the Dominion government, was presented with a leather chair by the employees of the Dominion Power & Transmission Company of Hamilton, Ont., on Dec. 3. Mr. Lutz prior to his present appointment was connected with the Dominion Power & Transmission Company for twenty years.

Mr. James F. Hobart, an occasional contributor to this journal, inventor and designer in the research department of the Diamond Match Company, Barberton, Ohio, resigned his position with that company on Dec. 5 to become superintendent of the Hanna Breckenridge Company of Fort Wayne, Ind. Mr. Hobart assumed his new duties on Dec. 9 and will be engaged in introducing improved methods and systematizing old ones in the largest machine shop in the world devoted to the rebuilding of woodworking machinery and the manufacture of hollow-blast grate bars.

Mr. W. E. Coman, at present general freight and passenger agent for the North Bank and affiliated Hill roads, has accepted the position of vice-president and general manager of the Northwestern Electric Company, effective early next year as soon as his successor is appointed. The Northwestern Electric Company is controlled by the Fleischhacker interests of San Francisco, which interests are also prominent in the Great Western Power Company, and it recently obtained a franchise for distributing electricity for light, heat and motor service in Portland, Ore., in competition with the Portland Railway, Light & Power Company.

Construction

GLOBE, ARIZ.—The Board of Supervisors has granted Nathan L. Amster a franchise to construct and operate an electric railway from Globe to Live Oak. The sale of the local franchise will be decided at an election to be held on Dec. 28.

SUPERIOR, ARIZ.—P. H. Hayes, H. Doggs, J. H. Thompson and J. B. Newman, of Globe, have formed a partnership to operate certain copper properties near Superior. Electricity will be used to operate the machinery at the mines, which will be secured from the plant at Ray, 10 miles distant. A high-tension transmission line on towers will be erected from Ray to the mines.

GRAVETTE, ARK.—Sealed proposals will be received by the secretary of the water and light improvement committee of Gravette, Ark., until Jan. 6 for furnishing material and constructing complete water-works and electric-light system for the town of Gravette as follows: Two 25-hp oil engines, two deep-well pumps, one 50,000-gal. steel tank on tower, one 30-kw alternating-current generator and appurtenances, 3250 ft. of 6-in. cast-iron pipe, class "B"; 4600 ft. 4-in. cast-iron pipe, class "B"; 1700 ft. 2-in. galvanized pipe, 14 two-nozzle hydrants, valves and cast-iron specials, 33,000 ft. No. 6 weatherproof copper wire and 8500 ft. pole line. Deep wells have been driven by the town. Plans can be secured from Nagel & Petersen, engineers, Muskogee, Okla., upon payment of $10. J. F. Dorset is the secretary of water and light improvement committee.

FRESNO, CAL.—The State Railroad Commission has granted the San Joaquin Lt. & Pwr. Co. permission to issue $925,000 in bonds, of which $320,000 will be issued at once to discharge outstanding indebtedness and the balance from time to time for the same purpose.

GLENDORA, CAL.—The City Trustees have called an election to be held on Dec. 18 to vote on the proposition to issue $30,000 in bonds to establish a municipal light and power plant. The present plant, owned by the Glendora Lt. & Pwr. Co., will be taken over and extensive improvements made.

LA CRESCENTA, CAL.—The Southern California Edison Co. is to erect a distributing system in this district to the Walton-Holmes 600-acre tract, which is to be opened to the public soon.

LOS ANGELES, CAL.—The Los Angeles Ry. Co. is planning to extend its Eighth Street line to the west limits of the city.

ONTARIO, CAL.—Plans are being considered for the installation of ornamental street lamps in the Bungalow Park subdivision on South Vine Avenue. A. M. Peddie is interested.

PERRIS, CAL.—Charles P. and Benjamin Rousseau, of Los Angeles, have purchased the H. B. Peabody ranch, near Perris, and propose to sink a well and install an electric pumping plant.

PLACERVILLE, CAL.—Negotiations are in progress among the ranchers, the United States Forestry Service and the Pacific Tel. & Tel. Co. for the erection of a telephone line between Tallac and the Forestry Service headquarters, connecting many private parties on the route. Evan Kelley, forestry supervisor, is endeavoring to carry negotiations through.

REDDING, CAL.—The Northern California Pwr. Co. is driving a 7000-ft. tunnel from Tamarack Falls reservoir through a divide to Cow Creek Valley, where the conserved water from Dry Burney Creek will be used to reinforce and govern the water supply of the Kilare plant and one which is to be built below this plant.

REDLANDS, CAL.—The Board of Trustees has accepted the design for ornamental lighting posts submitted by the H. F. Kierluff Co., of Los Angeles, and bids will be asked for at once for 132 posts and connections.

RIVERSIDE, CAL.—Koebig & Koebig, Title Insurance Building, Los Angeles, are preparing plans for the Southern California Utilities Co. for a hydroelectric project in connection with the development of 30,000 acres of land in the San Jacinto Valley in Riverside County. The company has received authority from the State Railroad Commission to issue $10,000,000 in bonds to carry out the project.

ROCKLIN, CAL.—The Town Trustees have granted the Great Western Pwr. Co., of San Francisco, a franchise to erect and maintain transmission lines along the streets and alleys of Rocklin.

SAN BERNARDINO, CAL.—The Pacific Lt. & Pwr. Corpn., of Los Angeles, is planning to erect a single 60,000-volt transmission line between Los Angeles and San Bernardino, via Riverside power station, a distance of about 65 miles. This is in connection with distributing the energy generated at the Big Creek receiving station near Los Angeles.

SAN FRANCISCO, CAL.—Plans are being prepared by the United Railroads to extend the San Bruno Avenue line south to Railroad Street.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Pwr. Co. has applied to the State Railroad Commission for permission to purchase the property of the Gold Mountain Wtr. Co., of Tuolumne County, for $27,500.

SAN JOSE, CAL.—Surveys have been completed and estimates made of the cost of an electric railway between San José and San Francisco, for which plans are now in the hands of R. S. Lovett, president of the Harriman lines.

STOCKTON, CAL.—The Western States Gas & El. Co. has applied to the State Railroad Commission for permission to issue $307,000 in bonds, the proceeds to be used to discharge existing obligations and for future extensions.

VISALIA, CAL.—The State Railroad Commission has authorized the Mount Whitney Pwr. & El. Co. to issue $250,000 in bonds to be used principally for work on the new hydroelectric plant on the Keweah River.

ALAMOSA, COL.—The Mutual El. Lt. & Pwr. Co. contemplates the purchase of six oil switches; also within the next three months it expects to purchase 25 meters, five 5-kw and one 25-kw transformer, and within the next two months one rectifier and 500 incandescent lamps. H. A. Goodridge is manager.

LAMAR, COL.—The Intermountain Ry., Lt. & Pwr. Co., of Lamar, is changing over its plant and entire distributing system from direct current to alternating current. The company has installed an Allis-Chalmers alternator and a General Electric switchboard, using the same boilers and engine. W. Corson is superintendent.

TALCOTTVILLE, CONN.—Arrangements are being made by Talcott Brothers, owners of the local electric-light plant, to secure electricity from the South Manchester Lt., Pwr. & Tramway Co. to operate the local system. A transmission line is being erected to the Manchester border to connect with the lines of the South Manchester company. Under the new system a 24-hour service will be established.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 7, 1913, for furnishing at the navy yard, Washington, D. C., seven electric traveling cranes, as per Schedule 5045. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Dec. 18, for cells, fuses, etc., as asked for under Proposal 628. Proposals will also be received until Dec. 17 for junction boxes, etc., as asked for under Proposal 627. Bids will also be received until Dec. 16 for cable splicers, chests, etc., under Proposal 626.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Dec. 21 under Proposal 629 as follows: Item 1—five fifty-line, common-battery switchboards, equipped with 50 common-battery and five magneto lines, complete with arrester cabinet; item 2—two 100-line, common-battery switchboards, equipped with 100 common-battery and 10 magneto lines, complete with arrester cabinet, in accordance with specifications and drawings.

CHIPLEY, FLA.—Application has been made to the City Council by Messrs. Hall and Gotha for a franchise to install an electric-light plant. If granted, they propose to build an ice and cold-storage plant.

OCALA, FLA.—The Florida Pwr. Co. expects to install within the next month one 1200-kva, three-phase, 60-cycle, 2200-volt General Electric generator and one S. Morgan Smith waterwheel. R. C. Camp is president.

OCALA, FLA.—Plans are well under way for the installation of an ornamental street-lighting system in Ocala. The lamps will first be placed about the Court Square and later will be extended on the principal streets. J. S. Caldwell is superintendent of the municipal electric-light plant.

ST. PETERSBURG, FLA.—Bids will soon be asked by the city for the installation of an electric fire-alarm system.

CANTON, GA.—Improvements are contemplated to the municipal electric-light plant within the next six months which will require the purchase of one 100-hp boiler, one 100-kw, 2300-volt, 60-cycle alternating-current generator and one 150-hp automatic engine; also one switchboard complete for handling above machine and a 60-kw unit. O. P. Galt is superintendent.

CARROLLTON, GA.—H. G. Lowney and associates of the Atlanta-Carrollton Ry. Co., to be organized, proposes to develop the water-power of Belle Shoals on Dog River in Douglas County, 23 miles from Carrollton. The cost of dam, power house and equipment is estimated at about $60,000. It is proposed to organize a company under the name of the Dog River Pwr. Co. to carry out the project.

ROME, GA.—The City Council has appointed a committee, consisting of Aldermen Copeland, McDonald and Irwin, to make investigations with a view to establishing a municipal electric-light plant in Rome.

AMBOY, ILL.—The street-lighting committee has incorporated in the contract to be submitted to the City Council plans for an ornamental lighting system.

ASSUMPTION, ILL.—The Central Illinois Pub. Ser. Co. has submitted a proposition to the City Council offering to furnish 82 incandescent lamps at $25 each per year. It is proposed to erect cluster lamps in the business section.

BENLD, ILL.—The United Lt. & Pwr. Co. proposes to substitute 85 series tungsten lamps for the 23 arc lamps and the 33 incandescent lamps now in use in lighting the streets of the village.

CLAYTON, ILL.—The Central Illinois Pub. Ser. Co. is negotiating for the purchase of the municipal electric-light plant in Clayton.

DECATUR, ILL.—The People's Co-operative Lt. & Pwr. Co. is seeking a franchise to construct and operate an electric plant here.

DU QUOIN, ILL.—The boiler shed, engine house, electrical machinery and a portion of the tipple of the Brilliant Coal Co. were destroyed by fire on Dec. 4, causing a loss of about $5,000.

EAST MOLINE, ILL.—The Automatic Tel. Co. is seeking a franchise in this village to operate a telephone system here.

FARMINGTON, ILL.—The People's El. Ser. Co., operating electric plants and distributing systems in Farmington, Fairview, London Mills and Cuba, has been purchased by R. F. Wallace, of Peoria, secretary of the Peoria Gas & El. Co. The new company, it is said, will make extensions to the system, including the erection of transmission lines to Trivoli and Hanna City.

HERRIN, ILL.—The plant and holdings of the Interurban El. Co., which supplies electrical service in Herrin and Carterville, has been purchased by the Central Illinois Pub. Ser. Co., of Mattoon.

HILLSBORO, ILL.—The People's Mutual Tel. Co. has been granted a 50-year franchise by the Village Board of Schram City to erect and operate telephone lines through that village. The proposed line will extend from Hillsboro to Irving.

KANE, ILL.—The Village Board has granted the Central Illinois Pub. Ser. Co., of Mattoon, a 50-year franchise to install and operate an electric-lighting system here.

KIRKLAND, ILL.—The Village Board has passed a resolution notifying the DeKalb County Tel. Co. to remove its poles and wires from the streets of Kirkland, provided the company insists on enforcing its new toll rates. It is reported that money has been raised to erect a telephone line connecting Fairdale, Kirkland, Kingston and Genoa.

LEWISTOWN, ILL.—The Lewistown Tel. & Teleg. Co. has applied for a franchise to construct and operate a telephone system in Lewistown.

MOUNT MORRIS, ILL.—The Illinois Northern Utilities Co., of Chicago, has purchased the distributing system and franchise of the Kable Brothers Co. in Mount Morris. The sale does not include the power house or equipment, with the exception of one engine and part of the switchboard.

OLNEY, ILL.—The Commercial Tel. & Telg. Co., recently incorporated with a capital stock of $500,000, will take over the telephone lines owned by H. H. Knipe in Robinson, Olney, Fairfield and Salem. The new company is planning to rebuild the Olney system.

PEKIN, ILL.—The Commercial Club has appointed a committee of Court Street business men to take steps to secure an ornamental street-lighting system on Court Street between Front and Seventh Streets. E. L. Conklin is president of the Commercial Club.

QUINCY, ILL.—The Board of Supervisors of Adams County has granted the Quincy Street Ry. Co. a franchise to extend its tracks on Main Street to Graceland Cemetery.

SPRINGFIELD, ILL.—The Springfield Lt., Ht. & Pwr. Co. having refused the offer of $10,000 made by the City Commission for the lighting system on the Fourth Street Boulevard, the commission will have plans prepared for an ornamental street-lighting system for the boulevard, to cost about $12,000. The system was installed by the company and sold to the park board, but a court decision held that the park board had no control over the street.

SPRING VALLEY, ILL.—The Spring Valley Gas & El. Co. contemplates the purchase of material for 50 miles of transmission lines within the next three months.

STERLING, ILL.—The City Council is investigating the street lighting system in North Dixon with a view of installing a similar system here.

WAVERLY, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, is said to be negotiating with H. J. Rodgers, of Waverly, for the purchase of his plant. A transmission line will be erected to Franklin to supply electricity for lamps and motors in that city.

WEST BROOKLYN, ILL.—The Illinois Northern Utilities Co., of Chicago, has been awarded a contract for lighting the streets of the town. The company will install a modern lighting system here. Charles B. Yonts is contract agent for the company.

ELWOOD, IND.—The Elwood El. Lt. Co. expects to purchase within the next two months seven new switchboard panels. The company has recently completed the erection of a 1500-kw substation, 35,000 volts, the installation of two 500-kw non-condensing turbines and the erection of a 35,000-volt transmission line to Alexandria. N. M. Argabrite is manager.

GOSHEN, IND.—Improvements will be made to the arc-lighting system and the park-lighting system in the business portion of the town. It has been decided not to sell the municipal electric plant for the present at least.

GREENFIELD, IND.—The Commissioners of Hancock County have contracted with the Terre Haute, Indianapolis & Eastern Trac. Co., of Terre Haute, for electrical energy to operate the county electric plant. W. H. Boyd has been appointed superintendent of the county electric and heating plant.

INDIANAPOLIS, IND.—The Board of Public Works has awarded the contract for the installation of a generator in the City Hospital to the Hatfield El. Co., to cost $2,773.

INDIANAPOLIS, IND.—Sealed proposals will be received by the Board of Trustees of Indiana University at the office of the secretary, Bloomington, until Dec. 17 for plumbing, heating, electric wiring, vacuum cleaners and electric elevators to be installed in the Robert W. Long Hospital, being erected in the city of Indianapolis by the board of trustees of Indiana University. Plans and specifications are on file at the office of the secretary at Bloomington, and at the office of R. P. Daggett & Co., architects, 956 Lemcke Annex, Indianapolis.

KOKOMO, IND.—The Kokomo, Marion & Western Trac. Co. expects to purchase during the next four months a new condenser to be used in connection with a 3500-kw steam turbine and generator about to be purchased.

MIDDLEBURY, IND.—The Town Board is considering a proposition submitted by Pidgeon Brothers, who recently purchased the mill in Middlebury, to furnish electricity to light the town.

PENDLETON, IND.—The managers of the municipal electric-light plant expect to install a new switchboard and four transformers and to erect about 4 miles of transmission lines within the next two months. F. J. Rector is superintendent.

SHERIDAN, IND.—The Sheridan Wtr., Lt. & Ht. Co. is making improvements and extensions to its plant, including the installation of two 150-hp Chandler & Taylor boilers, two 150-hp engines and two 100-kw, 2300-volt, three-phase, 60-cycle generators, a 100-ft. standpipe and 5½ miles of watermains. The engines have not yet been purchased. C. E. Layton is secretary and treasurer.

ADEL, IA.—The Adel Mill Co., which was recently granted a franchise in Dallas Center, 8 miles distant, will erect a transmission line carrying 6000 volts to that town. The street-lighting system in Dallas Center will consist of about 75 series tungsten 5.5-amp lamps. Material for the extension has been purchased. The company is installing a 50-in. Sampson turbine waterwheel, which with the two already installed will increase the output of the water-power plant to 360 hp. The company also has an auxiliary steam plant of 175 kw. The generating equipment consists of one 100-kva and one 75-kw Westinghouse revolving-field generator. The 75-kw generator will probably be replaced with a 150-kw machine in the spring. L. M. Macy is president.

RED OAK, IA.—The property of the Red Oak El. Co. has been purchased by the Eaton-Abbott Co., of Cleveland, Ohio.

SHENANDOAH, IA.—The Eaton-Abbott Co., of Cleveland, Ohio, has purchased the property of the Shenandoah Artificial Ice, Ht., Pwr. & Lt. Co. and the People's Gas Co., of Shenandoah. J. A. Masters is president of the Shenandoah company.

GARDEN CITY, KAN.—The City Council has passed an ordinance calling for a special election to be held on Dec. 16 to vote on the proposition of issuing $40,000 in bonds for the installation of a municipal electric-light plant.

MANHATTAN, KAN.—The Manhattan Ice, Lt. & Pwr. Co. expects to purchase within the next two months equipment for multiple tungsten lamps for ornamental lighting system on three blocks. Contract for posts has been placed with the King Foundry Co., of St. Joseph, Mo. E. A. Wright is manager.

NEODESHA, KAN.—The managers of the municipal electric-light plant contemplate the installation of a 100-kw alternating-current generator within the next six months. Charles M. Kimball is manager.

NORTONVILLE, KAN.—The local electric-light plant was destroyed by fire recently, causing a loss of about $2,000. Work will begin at once on rebuilding the plant. The town will be without electric service until the plant is rebuilt.

OKETO, KAN.—At an election held Nov. 25 the proposition to issue bonds for the installation of an electric-lighting system was carried.

SALINA, KAN.—The Shellabarger Mill & Elevator Co. has awarded contract for construction of power house, 40 ft. by 80 ft., to C. W. Sibley. The plant will have an output of 500 hp and will supply electricity to operate the mill elevators and machine shops of the company. The contract for electrical machinery was awarded to the Busch-Sulzer Co., St. Louis, Mo. Gas engines will be used.

SCRANTON, KAN.—Steps have been taken by the City Council to secure estimates of the cost of installing a municipal electric-light plant here.

WHITEWATER, KAN.—The Whitewater El. Co., a subsidiary of the Whitewater Milling & Elevator Co., will install an electric plant and small ice plant here. The equipment will include boilers, equipped with fuel oil burners; two engines, 40 hp and 50 hp; two generators; electrical equipment not fully decided upon. Estimates are now being made for distributing system; 30 incandescent lamps will be required for street-lighting system and about 100 meters will be required. Most of the work will be done by local labor. R. H. Farr is president and manager.

GLASGOW, KY.—The Glasgow El. Lt. & Pwr. Co. has placed contracts for new machinery for its plant. It is expected to have the system completed by Jan. 1, when a 24-hour service will be established.

LAWRENCEBURG, KY.—The Lawrenceburg Lt. & Pwr. Co. will enlarge its power plant so as to enable it to furnish electrical service in Versailles and Tyrone, Ky. Harry Reed is manager.

LOUISVILLE, KY.—The Louisville Ltg. Co. expects to install two motor-generator sets within the next two months. P. T. Glidden is general manager.

MIDDLEBORO, KY.—S. M. Wilkes, of Lexington, engineer, has announced that negotiations are under way for the construction of a power plant on Cumberland River near the center of Bell County. The plant when completed will supply electricity within a radius of 40 miles. The Continental Coal Corpn. is said to have already contracted for energy for 14 of its mines. Philadelphia and Chicago capitalists are reported to be behind the project.

MOUNT STERLING, KY.—Deeds have been filed conveying the properties of the Mount Sterling Wtr., Lt. & Ice Co., of Mount Sterling, and the Winchester Ry., Lt. & Ice Co., of Winchester, to the Kentucky Utilities Co., of Louisville. Extensive improvements, it is said, will be made to the Mount Sterling system, including the erection of transmission lines over the county in order to supply electricity to farmers for lamps, heat and motors. Plans are also being considered for building an electric railway.

LAKE CHARLES, LA.—The Lake Charles Ry., Lt. & Wtr. Wks. Co. contemplates the purchase of motor-driven pumps for the water-works system in the near future.

PRESQUE ISLE, MAINE.—The Maine & New Brunswick El. Pwr. Co. expects to equip within the next 30 days 3 miles of 11,000-volt transmission line to supply electricity in Grand Falls, N. B.; also to erect 12 miles of 11,000-volt transmission line to the line of Caribou, Maine, for railway substation. The company also expects to install switchboard equipment for a 33,000-volt transmission line within the next two months. C. O. Austin is superintendent.

CUMBERLAND, MD.—The Edison El. Ilg. Co. is installing a 1000-kw Curtis turbine with 4000-ft. surface condenser, manufactured by the C. H. Wheeler Mfg. Co., Mullen suction valveless air pumps and Pratt forced-draft cooling tower. The company expects to purchase within three months one 450-hp water-tube boiler with feed pumps and piping and various transmission-line equipment, transformers, copper wire, etc. George A. Eyler, electrical engineer, has charge of the work.

CHICOPEE, MASS.—The Board of Aldermen has granted the Warren Pwr. Co. a franchise to erect transmission lines for the distribution of electricity in Chicopee.

TURNERS FALLS, MASS.—The Franklin El. Lt. Co. expects to erect within the next three months a substation at Millers Falls and to purchase equipment for a 300-kw load and also to rebuild the entire system at that place. M. H. Mahoney is superintendent.

WESTBORO, MASS.—The Westboro Gas & El. Co. will add a 350-kw indicating wattmeter. The company has recently purchased two 40-kw, 6600-volt to 2300-volt transformers for substation in Westboro to replace two 20-kw transformers. H. F. Hemenway is superintendent.

BAY CITY, MICH.—The electric-light committee of the City Council has announced its decision to make improvements to the municipal electric-light plant, to cost about $20,000.

BENTON HARBOR, MICH.—The Benton Harbor-St. Joe Ry. & Lt. Co. has been granted a 30-year franchise for crossing any and all highways in Watervliet Township and to furnish electricity in that town. The company will also submit the same proposition to the people of Hartford Township.

EATON RAPIDS, MICH.—The Council has authorized the Board of Public Works to purchase a new dynamo to replace the one disabled a few weeks ago.

ECORSE, MICH.—The Worcester Salt Co. is reported to be in the market for a 150-kw, 125-volt generator to be direct-connected to Corliss engine. W. B. Powell is superintendent.

FRANKFORT, MICH.—The Benzie County Pwr. Co. expects to build within the next eight months a dam and complete power station and to purchase within four months poles, wires, arresters, transformers, arc lamps, etc. Contracts have been placed for generators, waterwheels and switchboard equipment.

GLADWIN, MICH.—The dam of the Gladwin Lt. & Pwr. Co. gave way on Dec. 4, causing a loss of about $25,000.

VASSAR, MICH.—One of the dynamos in the municipal electric-light plant was totally wrecked on Dec. 2. A new generator has been ordered.

HINCKLEY, MINN.—The Village Council has adopted an ordinance declaring the franchise of the Hinckley El. Co. forfeited. The franchise was terminated owing to the unsatisfactory service given.

WARREN, MINN.—At present the municipal electric-light plant is overloaded and new equipment will be needed, which will include a 125-kw, 250-volt direct-current generator, engine and switchboard panel complete, and also recording instruments. W. Haney is superintendent.

MAGNOLIA, MISS.—The Magnolia El. Lt. Co. expects to purchase within the next month three ammeters and three-pole, double-throw oil switches. Javier A. Kramer is manager.

MARCELINE, MO.—Plans are being considered for the installation of additional power equipment within the next six months for the municipal electric-light plant, but nothing definite has yet been decided upon. L. A. Nickell is superintendent.

LINCOLN, NEB.—The Board of Public Lands and Buildings has decided to close down the lighting plants owned by the State and secure service from private companies for the different state institutions.

NORFOLK, NEB.—Extensive improvements will be made by the Nebraska Tel. Co. to its local system during the next few months, involving an expenditure of about $56,000.

SCOTTSBLUFF, NEB.—The Cross & Roberts El. Co. expects within the next six months to erect two 13,000-volt substations and to purchase one voltage regulator and one synchronous panel; also 19 miles of transmission equipment for 13,000 volts, three-phase; No. 6 copper wire. The company will also be in the market for general devices for use on day service. F. H. Roberts is president.

ROCHESTER, N. H.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 29 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Rochester, N. H. Drawings and specifications may be obtained from the custodian of site at Rochester, N. H., or at the above office. Oscar Wenderoth is supervising architect.

HIGHTSTOWN, N. J.—The El. Lt. & Pwr. Co., of Hightsown, has presented a plan to the Council to change the present arc-lamp street-lighting system to a series tungsten circuit.

NEWARK, N. J.—Bids will be received at the office of the Board of Education, Newark, N. J., until Dec. 17 for construction and erection of special lighting fixtures for the Newark Normal School to be installed complete by Feb. 1, 1913. Blank proposals can be obtained at the board's construction department, fourth floor, city hall, where drawings and specifications may be examined. R. D. Argue is secretary.

PASSAIC, N. J.—The New York & New Jersey Pwr. Corpn., recently incorporated, has applied to the Board of City Commissioners for a five-year light and power franchise.

ARTESIA, N. M.—The Artesia Lt. & Pwr. Co. is preparing to install additional machinery and equipment at its plant, to cost about $300,000. The company will erect transmission lines from its power plant in Artesia to farms in this section and furnish electricity to operate pumping plants. Several hundred acres are being developed by the company, upon which it is boring wells and installing motors and pumps. Among the machinery to be installed are two 450-hp Diesel engines. John C. Keys is president.

CLOUDCROFT, N. M.—The construction of an electric interurban railway to run between Cloudcroft and Carlsbad, a distance of about 100 miles, is being promoted by Morgan Hand, of Kansas City, Mo., and C. C. Carroll. The promoters also contemplate the installation of a hydroelectric plant on Penasco River to provide electricity to operate the proposed railway and also for the towns in this section.

AMES, N. Y.—The Ames Improvement and Protective Organization has decided to accept the proposition of the Montgomery El. Lt. & Pwr. Co., of Canajoharie, for lighting the streets of the village. The contract is for a period of five years and calls for 12 street lamps.

ARCADE, N. Y.—At a special election held Nov. 27 the proposition to issue $9,500 in bonds for the purchase of additional equipment for the municipal electric-light plant was carried. A new boiler and dynamo will be installed.

ORWELL, N. Y.—The Public Service Commission has granted the Salmon River Pwr. Co. permission to exercise ten franchises for the distribution of electricity through certain towns and villages in Oswego and Onondaga Counties. The company, which is controlled by the Niagara, Lockport & Ontario Pwr. Co., proposes to construct a hydroelectric power plant on Salmon River in the town of Orwell and to erect transmission lines through this town and the towns of Richland, Albion, Parish, Hastings and the villages of Altmar and Central Square, Oswego County, and the towns of Cicero, Clay and Salina, Onondaga County, to the village of Solvay, where the lines will connect with the transmission lines of the Niagara, Lockport & Ontario Pwr. Co.

OSWEGO, N. Y.—The People's Gas & El. Co., of Oswego, is experimenting with new arc lamps with a view of improving the street-lighting system. If accepted, the lamps will be installed through the business district first and later throughout the entire system. R. F. Whitney is manager.

THIELLS, N. Y.—Plans for the buildings of Letchworth Village, as the institution for the segregation of epileptics and feeble-minded is to be known, and for which the State has acquired a large tract of land at Thiells, have been carried to the point where contracts can be let for ten buildings. The plans call for a total expenditure of about $3,500,000. At the last session of the Legislature $457,000 was appropriated for the first ten buildings, for which contracts will soon be advertised. A power plant, storehouse, laundry and shop will be included in the first group and will serve the entire village when it is completed. Frank A. Vanderlip, president of the National City Bank, of New York, is president of the board of managers of Letchworth Village.

WATERTOWN, N. Y.—The International Paper Co. is planning to erect a new mill and power plant near its group of mills at Glen Park, for which surveys have already been made. The new building will be located near the Woods Falls dam, where it is proposed to increase the power development by the construction of a new concrete dam with bulkhead and flumes. The additional development will make it possible to operate many of the grinders by electricity. The mill will contain a sulphite plant to take the place of the one on Sewall's Island.

WILLIAMSVILLE, N. Y.—Arrangements are being made by the Board of Trustees for an electric-light system for the village, for which contracts will be awarded in a few days.

ANDREWS, N. C.—Extensive improvements and additions are contemplated to the municipal electric-light plant within the next 12 months, which will include the erection of a new power plant and increasing the output by about 350 hp; also the purchase of one 500-kw generator, one exciter, waterwheel and governor, switchboard and fixtures, and also material for lighting system, including cable and insulators; also for electrical supplies of all kinds. James A. Thornton is superintendent.

CHARLOTTE, N. C.—The Southern Pwr. Co. will construct a hydroelectric plant to develop Lookout Shoals on Catawba River, 12 miles from

Statesville. Four units of 4000 hp each will be installed. The cost of the plant is estimated at $1,000,000. W. S. Lee, of Charlotte, is chief engineer.

WILMINGTON, N. C.—The Tidewater Pwr. Co. expects to build within the next six months a brick substation building and to purchase within the next three months one 500-kw rotary converter and two 250-kva transformers and switchboards for rotary and transformers. The company is now erecting one 264-hp Babcock & Wilcox boiler. Raymond M. Hunt is superintendent.

FARGO, N. D.—Sealed proposals will be received by A. R. Watkins, city auditor, until Dec. 23 for furnishing all material and construction of a "white way" in "white-way" district No. 2 of the city of Fargo, extending on Front Street from Eighth Street to First Street, according to plans and specifications which are on file in the office of the city auditor.

AKRON, OHIO.—Plans are being considered by the city authorities for changing the street-lighting system in the business district. The plans call for standards set 50 ft. apart, with lamps aggregating 1200 cp. It has not been decided how many lamps will be used to the standard.

CINCINNATI, OHIO.—The Union Gas & El. Co., Cincinnati, is contemplating the purchase of one feed pump and one feed heater.

CINCINNATI, OHIO.—Sealed proposals will be received at the office of the director of public service, City Hall, Cincinnati, Ohio, until Dec. 19 for the installation of an electric-lighting system for the Gilbert Avenue Viaduct. Plans, specifications and blank proposals can be obtained at the office of the chief engineer, Department of Public Service. V. T. Price is director of public service.

CLEVELAND, OHIO.—Sealed proposals will be received at the office of W. J. Springborn, director of public service, Room 104, City Hall, Cleveland, until Dec. 18 for furnishing, lighting and maintaining electric street lamps and equipment for the year 1913, in accordance with plans and specifications which may be obtained at the office of the superintendent of street lighting.

HICKSVILLE, OHIO.—The Hicksville El. Lt., Ht. & Pwr. Co. contemplates within the next two months the purchase of one 40-kw and one 75-kw, 2300-volt, three-phase, 60-cycle generator with switchboard; also one 25-kw transformer and other smaller transformers. C. M. Lott is president and manager.

MASSILLON, OHIO.—The Massillon El. & Gas Co. expects to erect within the next three months 16 miles of 22,000-volt, three-phase transmission line and 15 miles of 2200-volt, three-phase transmission line and two substations, material for which has already been purchased. The company has also recently placed contracts for one 1250-kva, 2300-volt, three-phase, 60-cycle General Electric turbine, one Le Blanc condenser, Westinghouse, and five 50-lamp General Electric rectifier sets. R. A. Brooks is manager.

MILAN, OHIO.—The Council has awarded a contract to Henry Neufer, of Norwalk, to furnish electricity for lighting the streets of the town, also for commercial lighting and domestic purposes. Mr. Neufer proposes to erect an electric plant here, work on which will soon begin. The municipal plant will be closed down.

NORWOOD, OHIO.—Extensive improvements are contemplated to the municipal electric-light system within the next 90 days, including the installation of 350 to 400 alternating-current series street arc lamps, one 350-hp gas engine and one 200-kw alternating-current generator, cooling tower, switching apparatus for generator and a few transformers for alternating-current system; also a water softener of 3,000,000-gal. capacity. H. C. Hubbell is superintendent.

TULSA, OKLA.—Application has been made to the City Council by Charles Page for an electric light, heat and power franchise in Tulsa. The proposition will be submitted to a vote on Jan. 20.

HILLSBORO, ORE.—The Washington-Oregon Corpn. expects to erect within the next two months 8½ miles of transmission line from Forest Grove to Gaston, Ore., and to build a 22,000-volt substation at Gaston. G. M. Turner is local manager.

ALTOONA, PA.—The City Council is considering the question of substituting tungsten lamps for many of the arc lamps now in use in the near future. The Penn Central Lt. & Pwr. Co. has the contract for street lighting.

HAMBURG, PA.—The Hamburg Gas & El. Co. expects to erect within the next six months about 6 miles of high-tension transmission lines and to purchase within the next 10 months one 450-hp water-tube boiler. A. J. Althouse is superintendent.

SENECA, S. C.—The Concross Lt. & Pwr. Co. will be formed to take over the property of the Seneca Lt. & Pwr. Co., of Seneca, which is now constructing a hydroelectric plant at Concross Shoals, 4 miles from Seneca. Two 500-hp turbines and other machinery are being installed. The cost of the work is estimated at about $50,000. Lewis W. Parker, of Greenville, S. C., is interested in the company.

HUMBOLDT, S. D.—The citizens have accepted the proposition submitted by Mr. Gronsdahl for the installation of an electric-light plant in Humboldt. The Town Board was authorized to make necessary arrangements for installing the system. Electrical energy to operate the system will be obtained from the electric plant in Hartford. The plans provide for a 24-hour service.

ELIZABETHTOWN, TENN.—The Watauga Pwr. Co. is planning to extend its transmission lines to Jonesboro, Morristown and Greenville, Tenn.

AUSTIN, TEX.—The Independent Pwr. Co., of Joplin, Mo., has been granted a permit to do business in Texas. The company is capitalized at $400,000 and will have its headquarters in this city.

BEEVILLE, TEX.—The Beeville Mfg. Co., which operates the local electric-light plant, has increased its capital stock from $10,000 to $50,000.

BRYAN, TEX.—The Bryan-College Interurban Ry. Co. is preparing to extend its railway down the valley of the Brazos River several miles. O. G. Gammil is general manager.

DENISON, TEX.—John R. Cullinane, of St. Louis, Mo., and associates are promoting the construction of an electric interurban railway that is to extend between Denison and Durant, Okla., a distance of about 30 miles. The same interests, it is stated, also contemplate the installation of a hydroelectric plant at some point on the Red River and the erection of transmission lines to Durant, Calera, Colbert and Denison. The construction of an electric railway in Durant is also contemplated.

EL PASO, TEX.—The Stone & Webster Engineering Corpn., of Boston, Mass., will soon begin work on construction of the interurban electric railway that is to extend from El Paso down the Rio Grande River to Fabens.

FREDERICKSBURG, TEX.—Work has begun on improvements to the local electric-light plant. In the near future an additional generator will be installed. The entire distributing system will be rebuilt.

HEREFORD, TEX.—The Hereford El. Lt. & Pwr. Co. expects to purchase within the next six months one low-pressure turbine and one condenser for exhaust steam, 15 miles of bare copper wire, motors, transformers and two irrigating pumps for wells on farm 8 miles distant. F. H. Obertheir is owner.

MINEOLA, TEX.—The Mineola Lt. & Ice Co. is in the market for a 30-kw, 35-kw or 40-kw, 2300-volt, 60-cycle, three-phase second-hand unit for winter day load. It must be direct-connected to turbine, simple side-crank engine. The company will also award contract for construction of 10,000-gal. water tank erected on a 100-ft. tower. It will also build a 500-ton ice-storage plant, to be insulated with cork, and will install a new set of 30-ton steam condensers, equip two ice tanks with compressed-air or motor lifts and two vaults with compressed-air or motor elevators. C. M. Dozier is manager.

PARIS, TEX.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 8, 1913, for construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the annex to the United States post office at Paris, Tex. Drawings and specifications may be obtained from the custodian at Paris, or at the above office. Oscar Wenderoth is supervising architect.

SMITHVILLE, TEX.—The Smithville El. Lt., Wtr. & Pwr. Co. expects to install within the next month one 150-kw Fairbanks-Morse oil engine and one 100-kva, 60-cycle Westinghouse alternator and also expects to purchase within the next three months one 50-kva, 60-cycle alternator, one 2-kva exciter, two 25-hp motors to drive pumps in the pumping plant; also one deep-well motor-driven pump, two ammeters, one voltmeter and switches for generator. Emil Buescher is owner and manager.

SALT LAKE CITY, UTAH.—The capital stock of the Utah Pwr. & Lt. Co. has been increased from $1,000,000 to $40,000,000. This company, which was formed by the consolidation of 14 of the largest hydroelectric power plants in Utah, Idaho and Colorado, will supply electricity for railroads, mines, mills and smelters. D. C. Jackling is president of the company.

SPRINGFIELD, VT.—The John T. Black Corpn., electrical department, expects to purchase within two or three months two boilers, one 500-kw turbine with all auxiliaries, one 15-kw exciter with turbine, one surface condenser for 500-kw turbine, one or two boiler-feed pumps, one air pump and a small amount of switchboard material. The company is now erecting 6 miles of transmission line to North Springfield and Gould Mills. J. Gardner Menut is manager.

STAUNTON, VA.—The Staunton Ltg. Co. is now erecting a substation at Waynesboro, Va., and is installing the following equipment: two 100-kva, 12,000-2200-volt, 60-cycle General Electric transformers at Waynesboro, two transformers of the same size and type at Staunton, and also three extra General Electric feeder panels. W. F. Ficklen, Jr., is superintendent.

CLE ELUM, WASH.—The Kittitas Ry. & Pwr. Co. will begin work on construction of the proposed electric line to the Cle Elum mining district in the spring. Simon Justham is interested.

SATSOP, WASH.—The Montesano Lt. & Wtr. Co., of Montesano, and the Elma Lt. & Pwr. Co. have applied to the County Commissioners for permission to erect an electric transmission line along the county road to Satsop and upon certain streets in the town.

SEATTLE, WASH.—The Seattle, Renton & Southern St. Ry. Co. has announced that the company will build 7 miles of road in the near future. E. M. Mills is interested.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. is planning to extend the Madison Street car line from Broadway to Fourteenth Avenue. About $125,000 will be expended.

WESTON, W. VA.—The Weston El. Lt., Pwr. & Wtr. Co. has awarded contract for a 1,000,000-gal. filtering plant to the Roberts Filter-

ing Co., of Philadelphia, Pa. Motor-driven pumps will be used, one 1800 gal. per minute and the other 700 gal. per minute. J. S. Mitchell is secretary and superintendent.

WHEELING, W. VA.—The ornamental street-lighting system for the business district advocated by the Board of Trade will soon be carried through. The ornamental poles will be erected jointly by the Wheeling Trac. Co., the West Virginia Trac. & Lt. Co., and the Wheeling Electrical Co. George W. Lutz, chairman of the committee of board of trade, is interested.

CEDARBURG, WIS.—The Common Council has issued $12,000 in bonds, the proceeds of which are to be used for the purpose of purchasing a new engine, switchboard and generator for the municipal electric plant.

LA CROSSE, WIS.—The contract for wiring work in connection with the new water plant was awarded to the Thill-Manning-Whalen Co. for $5,963. The work will consist of erection of transmission line from pump house to substations, all materials to be supplied by the company.

LANCASTER, WIS.—The Lancaster El. Lt. Co. is considering plans for the construction of a new plant. The company expects to erect transmission lines to Fennimore, Bloomington and Potosi.

RICHLAND CENTER, WIS.—The purchase of a 500-hp direct-connected unit, 1150-volt, three-phase, 60-cycle, for the municipal electric-light plant is under consideration. R. H. Strang is superintendent.

EDMONTON, ALTA., CAN.—Extension and improvements are contemplated to the Edmonton Radial Railway during the winter, including the construction of two new substations; also the purchase of one 750-kw motor-generator set, two 500-kw transformers and one 750-kw transformer.

KAMLOOPS, B. C., CAN—The date for opening tenders for furnishing 1000-hp steam and electrical pumping equipment for the new power station has been extended from Dec. 5 to Dec. 19. Ducane, Dutcher & Co., Rogers Building, Vancouver, B. C., are consulting engineers. J. J. Carment is city clerk.

SOURIS, MAN., CAN.—The Town Council is contemplating the installation of an electric-light plant to cost about $40,000. A by-law will be submitted to the ratepayers in December.

DALHOUSIE, N. B., CAN.—We are informed that the contract for installing the proposed electric-light plant will not be awarded before spring. Willis Chipman, of Toronto, Ont., is consulting engineer.

HAMILTON, ONT., CAN.—Plans are under way for an addition to the transformer station, to cost about $4,000. George H. Lees is Mayor and S. H. Kent clerk.

ST. CATHARINES, ONT., CAN.—Preparations are being made by the Niagara, St. Catharines & Toronto Ry. Co. to build a new power house in St. Catharines.

TORONTO, ONT., CAN.—Plans have been prepared for an addition to the battery house of the Toronto El. Lt. Co., on Terauley Street, to cost about $8,000. H. G. Salisbury, 12 Adelaide Street, Toronto, is architect.

TORONTO, ONT., CAN.—The Toronto Pwr. Co. contemplates the erection of a transmission line from Niagara Falls to Syracuse and will enter into competition with the Ontario Pwr. Co. Plans have already been prepared for the transmission line in New York State and will follow a right-of-way secured some years ago. The Toronto company secures its energy from Niagara Falls through the Electrical Development Co. Sir William MacKenzie is president of the Toronto company.

WEST LORNE, ONT., CAN.—Excavating has started on the proposed electric-light plant of the West Lorne El. Lt. Co. Contract for machinery has been placed with the Canadian Fairbanks-Morse Co., of Toronto. W. Webster is manager.

MONTREAL, QUE., CAN.—The stockholders of the Cedar Rapid Mfg. & Pwr. Co., of Montreal, have authorized an increase in capital stock from $10,000,000 to $15,000,090.

MONTREAL, QUE., CAN.—The National Hydro-Electric Co. has taken another step toward supplying Montreal with power from its proposed power plant at Carillon Falls. The company at present is operating a small plant, but is contemplating an extensive installation capable of developing 160,000 hp and which will involve an expenditure of about $10,000,000. The small plant will be used in connection with building the large plant and also to supply electricity to neighboring municipalities. The company has a Dominion charter enabling it to do business in this Province, and application has been made to the Provincial Legislature to give it the right of placing poles and wires in municipalities without dealing with each one in particular. Power is also sought to use the Montreal conduits for its transmission lines, while pending the construction of conduits it is asked that rights for poles and wires be granted. The company asks for permission to operate in Assumption, Terrebonne, Two Mountains, Jacques Cartier, Laval, Montcalm, Joliette, Berthier, Richelieu, Missisquoi, Vaudreuil, Argenteuil, Soulanges, Chambly, Chateauguay, Beauharnois, Ottawa, Iberville, St. John and Labelle. Mr. Mills is president of the company.

MEXICO CITY, MEX.—The Mexican Mines, Ltd., of El Oro, Mex., has applied to the federal Department of Fomento for a concession to use the water of the Los Ocotes arroyo. The company will install a hydroelectric power plant to generate electricity to operate the machinery, etc., at its mines in El Oro.

New Industrial Companies

THE AUTO SAFETY SIGNAL LAMP COMPANY has been incorporated under the laws of the State of Delaware with a capital stock of $100,000 by L. Abeles, J. J. Drew, of Philadelphia, Pa., and J. G. Gray, of Wilmington, Del.

THE BURGOON-MATHEWS ELECTRIC COMPANY, of Birmingham, Ala., has been incorporated with a capital stock of $35,000 to deal in electrical supplies. The officers are H. W. Mathews, president; J. W. Ege, vice-president. and C. E. Burgoon, secretary and treasurer.

THE CHICAGO SAFETY APPLIANCE COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 to manufacture safety appliances by F. A. Lathrop, F. P. Mason and S. A. Dugger.

THE CONTINENTAL ELECTRIC & MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by I. Cohen, Samuel Finkelstein and Eugene L. Fisk, 39 West Seventeenth Street, New York, N. Y.

New Incorporations

WILMINGTON, DEL.—The Eastern Mexico Pwr. & El. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000. The incorporators are: H. E. Latter, W. J. Maloney and N. P. Coffin, of Wilmington, Del.

CHICAGO, ILL.—The Chicago & Northern Interurban Ry. Co. has been incorporated with a capital stock of $100,000 by W. A. Miller, F. W. Hochspeier, O. J. Smith, W. E. Swanson and G. L. Starbird. The company proposes to operate a railway from Chicago through the townships of Niles, Maine and Wheeling.

MULBERRY, IND.—The Mulberry Lt. & Pwr. Co. has been incorporated with a capital stock of $13,000 by David H. Yund, Martin S. Strickel, Albert Welden, Daniel Rex and others. The company proposes to install and operate an electric plant in Mulberry.

OTTAWA, KAN.—The Overland El. Co. has been organized with a capital stock of $30,000 by Joseph Beeler and others. The company proposes to purchase electricity from the municipal electric plant in Ottawa and distribute same between Ottawa and Pomona, Centropolis and Homewood.

Trade Publications

ELECTRICAL ENGINEER'S SLIDE-RULE.—Mr. King G. Kellogg, consulting engineer, 1836 South Fifty-fifth Street, Philadelphia, Pa., is distributing a four-page leaflet referring to a new electrical engineer's slide-rule. Mr. Kellogg's device is the result, as stated in his leaflet, of the demand for a slide-rule that the practically but not technically trained engineer can use without special study. This rule is so constructed as to solve electrical problems directly in millivolts, volts, feet, thousand feet, circular mils, etc.

REFLECTORS AND GLOBES.—The General Electric Company, Ltd., London, England, has recently issued a comprehensive catalog devoted to Holophane and Holophane-Benjamine products. The work is printed on fine art paper and is excellently illustrated. A description of scientific illumination is given. The new inverted type of Holophane bowls used with the indirect lighting system is described and illustrated, as are also the "Uniflex" reflectors and reflector bowls. The general arrangement of the catalog is good, and it will be found of special value to all dealers handling the Holophane line. Ready reference to any particular type of lamp has been made exceptionally easy by the general plan of the book, which gives the stock number opposite each different type, arranged in numerical order.

ELECTRIC SUPPLIES.—Simplex Conduits, Ltd., of London, England, has issued a massive catalog of 504 pages, size 8½ in. by 11 in., which will interest all users of electric lighting and motor-service supplies. The general arrangement of the catalog is excellent. It is divided into twenty different sections, heavy sectional divisional leaves with tabs on which is printed the title of the section making ready reference to any particular division especially easy. Concise details, with numerous illustrations, are given of all classes of material for electric wiring, and prices and full particulars of many energy-consuming devices are included. As a model of the thoroughness with which the company has handled the subject of conduits in this catalog, that particular section is worthy of mention. All details are tabulated, and a scale illustration of each type of fitting and of each size in which that particular type is manufactured are given. The catalog is well printed on fine coated paper, contains good illustrations, an exceptionally complete index with cross-references, is bound in red cloth, and is altogether a very ambitious and creditable catalog which will be found a useful volume for the trade in general.

Business Notes

THE SIEMENS-SCHUCKERTWERKE, G. m. b. H., Berlin, Germany, has established a branch office in Sao Paulo, Brazil.

THE EVENS & HOWARD FIRE BRICK COMPANY has opened a branch sales office in the First National Bank Building, Chicago, with H. E. Risher in charge. The general offices and works of this company, which has recently brought out a new ventilated boiler-furnace arch, are in St. Louis.

THE ARMATURE & MOTOR WORKS, 66 West Fort Street, Detroit, will begin a general repair and construction business on Jan. 1. Mr. J. C. Swach, who was for twenty-two years an erecting engineer for the Crocker-Wheeler Company, will superintend all the works, and Mr. W. J. Hartwig, 205 Jefferson Street, Detroit, will be one of the officers.

CANADIAN TUNGSTEN LAMP COMPANY, Hamilton, Ont., has arrived at a settlement with the Canadian General Electric Company in reference to a patent suit concerning tungsten lamps which was started by the latter against the former, and has secured from the Canadian General Electric Company a license to manufacture and sell lamps with drawn-wire tungsten filaments.

UNION ELECTRIC & CONTRACTING COMPANY.—Mr. Frank Goodwyn, who for the past few years has been general sales manager of the Canadian Tungsten Lamp Company, Ltd., and of the Ontario Lantern & Lamp Company, Ltd., of Hamilton, Ont., has severed his connections with these concerns and formed the Union Electric & Contracting Company, with Mr. Ambrose Moore. The company is carrying on a general electrical contracting business, with an office at No. 84 King Street East, Toronto, Ont.

ELECTRIC MAINTENANCE COMPANY.—The Electric Maintenance Company, of 117 South First Street, Louisville, Ky., has been formed to extend expert and practical service to users of motors in the Gateway City. Its work consists in regularly inspecting the motor equipment of factories, keeping apparatus in repair, etc. In this way equipment of central-station customers is kept in a condition of maximum efficiency, and the Electric Maintenance Company is supported by the approval of central station and consumer alike. Mr. E. A. Prince is manager.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 3, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,045,809. HANGER FOR TROLLEY WIRES; O. W. Brenizer, Philadelphia, Pa. App. filed June 30, 1910. Detachable clamping jaws.

1,045,822. PROCESS OF MAKING BATTERY PLATES; E. G. Dodge, South Orange, N. J. App. filed Nov. 4, 1911. Copper oxide is fired on an earthy base.

1,045,823. BATTERY PLATE; E. G. Dodge, Newark, N. J. App. filed July 1, 1907. Copper oxide on a fused backing.

1,045,845. TELEPHONE SYSTEM; E. R. Hobbs, Buhl, Idaho. App. filed May 15, 1909. Central-station connection between magneto and common-battery line circuits.

1,045,862. ELECTRIC BATTERY; G. A. Lutz, Plainfield, N. J. App. filed July 29, 1909. Circular copper oxide and zinc plates.

1,045,866. CIRCUIT-BREAKER; J. N. Mahoney, Wilkinsburg, Pa. App. filed Oct. 8, 1910. Pneumatically operated.

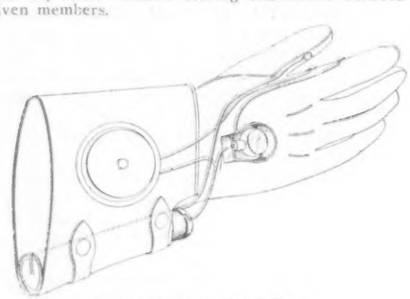
1,045,867. TROLLEY; P. A. McCullough, Pittsburgh, Pa. App. filed Oct. 14, 1910. Wheel with contact block.

1,045,880. BATTERY; W. Petrchell, Winnipeg, Manitoba, Canada. App. filed Feb. 27, 1911. Sealed carbon and zinc type.

1,045,892. HIGH AND LOW WATER ALARM FOR STEAM BOILERS; C. E. Robison, Harrisburg, Pa. App. filed Feb. 16, 1911. Float-actuated.

1,045,897. SWITCH; F. J. Seyerle, Pittsburgh, Pa. App. filed Aug. 21, 1911. Knife switch with thermostatic device.

1,045,909. SYNCHROROTOR; E. G. Thomas, Brooklyn, N. Y. App. filed Oct. 23, 1909. Elastic driving connection between the driving and driven members.



1,046,225.—Signaling Device.

1,045,911. ELECTRIC METAL-WORKING MACHINE; E. Thomson, Swampscott, Mass. App. filed March 4, 1911. Work holder for welding machine.

1,045,925. SERVICE METER SYSTEM; C. S. Winston, Chicago, Ill. App. filed Jan. 9, 1908. Two-wire central-energy telephone register.

1,045,948. ELECTRODE FOR WELDING; W. B. Cleveland and W. E. Huber, Cleveland, Ohio. App. filed March 15, 1909. For rail binding.

1,045,953. MULTIPLEX-TELEGRAPH SYSTEM; M. M. Davis and A. J. Eaves, New York, N. Y. App. filed Feb. 7, 1912. For shunting outgoing signal currents.

1,045,959. MOTOR-CONTROL SYSTEM; I. Eaton, Schenectady, N. Y. App. filed June 13, 1912. Dynamic braking.

1,045,967. TRANSMITTER CASING; F. Gottschalk, New York, N. Y. App. filed Feb. 12, 1912. Airtight and watertight casing.

1,045,968. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Feb. 16, 1912. Rolled or tempered diaphragm having initial stress.

1,045,969. TELEPHONE TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Feb. 10, 1912. Watertight construction.

1,045,972. SECTION INSULATOR; F. Guillot, Schenectady, N. Y. App. filed Oct. 10, 1907. For high-tension trolley lines.

1,045,975. ELECTRIC WATER HEATER; C. O. Haskel, Los Angeles, Cal. App. filed Oct. 31, 1908. Double-shell casing.

1,045,979. SWITCHING APPARATUS; E. C. A. Hoh, Brooklyn, N. Y. App. filed April 1, 1910. Electric sign flasher.

1,045,981. SAFETY DEVICE FOR ELECTRIC CIRCUITS; E. H. Jacobs, Schenectady, N. Y. App. filed Aug. 22, 1910. Control of motor circuits for machine shops, etc.

1,045,985. CRYOLITE RUTILE COMPOSITION; E. Kraus, Lynn, Mass. App. filed Aug. 3, 1911. Thermal cut-out, motor starter, etc.

1,046,004. VACUUM-TUBE LAMP; D. McF. Moore, Newark, N. J. App. filed Jan. 5, 1905. Interior non-arcing electrode of porous material impregnated with shellac.

1,046,043. METHOD AND APPARATUS FOR REDUCING CHEMICAL COMPOUNDS; E. Weintraub, Lynn, Mass. App. filed Oct. 27, 1909. Hydrogen acts upon boron halid at high temperature.

1,046,057. ELECTRIC-CONTROL MECHANISM FOR DRIVING MECHANISM; C. A. Dresser, Chicago, Ill. App. filed Nov. 11, 1911. For printing presses, etc.

1,046,066. ELECTRIC WELDING; I. Harmatta, Szepesváralja, Austria-Hungary. App. filed Dec. 3, 1903. Spot welding broadly; article and process claims.

1,046,067. MEANS FOR SECURING CONDUCTOR TERMINALS; G. W. Hart, West Hartford, Conn. App. filed May 20, 1912. For automobile switches, etc.

1,046,081. VAPOR ELECTRIC APPARATUS; C. A. Kraus and R. D. Mailey, Newton Highlands and Lynn, Mass. App. filed Aug. 27, 1909. Electrode attachment.

1,046,082. VAPOR ELECTRIC APPARATUS; C. A. Kraus and R. D. Mailey, Newton Highlands and Lynn, Mass. App. filed June 30, 1910. Interior electrode supports.

1,046,083. VAPOR ELECTRIC APPARATUS; C. A. Kraus and R. D. Mailey, Newton Highlands and Lynn, Mass. App. filed June 30, 1910. A screen between the electrodes.

1,046,084. JOINT; C. A. Kraus, Newton Highlands, Mass. App. filed Sept. 8, 1910. Gastight joint for vacuum tubes.

1,046,085. JOINT; C. A. Kraus, Newton Highlands, Mass. App. filed March 2, 1910. Gastight metal joint.

1,046,086. VAPOR-ARC CIRCUIT-BREAKER; C. A. Kraus, Newton Highlands, Mass. App. filed April 5, 1912. Alternating-current transmission system.

1,046,103. ELECTRIC HEATER; L. F. Parkhurst, Pittsfield, Mass. App. filed April 26, 1909. Fastening device.

1,046,119. AUTOMATIC OIL SWITCH; H. L. Smith, Schenectady, N. Y. App. filed May 17, 1905. Indicating attachment.

1,046,154. TROLLEY-POLE STAND; E. U. Down, Bowling Green, Ohio. App. filed June 9, 1911. Quick, detachable support.

1,046,211. METHOD OF MAKING ELECTRIC COILS; J. L. Milton, Chicago, Ill. App. filed Nov. 12, 1910. Wire insulation and heads vulcanized after assembling.

1,046,225. SIGNALING DEVICE; C. A. Schindler, West Hoboken, N. J. App. filed April 6, 1912. Glove with light for chauffeurs.

1,046,227. ELECTRICAL CONNECTOR; A. J. Seemann, Milwaukee, Wis. App. filed Oct. 8, 1910. Car coupler.

1,046,235. TROLLEY; L. I. Tetlow, West Springfield, Mass. App. filed March 28, 1912. Wheel contacts.

1,046,239. ELECTRIC WELDING MACHINE; F. Warren, Cincinnati, Ohio. App. filed Aug. 11, 1911. Die-controlling hand-lever support.

1,046,240. ELECTRIC WELDING MACHINE; F. Warren, Cincinnati, Ohio. App. filed Aug. 11, 1911. Spot welding of boxes, stoves, etc.

1,046,288. ELECTRODE FOR SECONDARY BATTERIES; H. Garde and A. J. Adams, London, England. App. filed April 14, 1910. Thin coiled electrode of the Faure type.

1,046,384. SWITCH; J. Gordon, Jr., East Orange, N. J. App. filed May 10, 1911. Hand switch with segmented contacts.

1,046,409. ICE-SCRAPING ATTACHMENT FOR TROLLEYS; S. A. Bemis (deceased), Springfield, Mass. App. filed Oct. 12, 1910. Non-rotative scraper.

1,046,410. MECHANICAL MOVEMENT AND ELECTRIC LIGHT SOCKET; T. A. C. Both, Malden, Mass. App. filed Dec. 30, 1911. Key-socket operator.

1,046,411. MECHANICAL MOVEMENT AND ELECTRIC-LIGHT SOCKET; T. A. C. Both, Malden, Mass. App. filed Dec. 30, 1911. Reversible push button.

1,046,416. JOINT; C. A. Kraus, Newton Highlands, Mass. App. filed Aug. 27, 1909. Insulated gastight joint.

1,046,421. PROCESS AND APPARATUS FOR PRODUCING CHEMICAL REACTIONS; J. L. R. Hayden, Schenectady, N. Y. App. filed Feb. 13, 1909. Oxygen and nitrogen reaction by electric arc.